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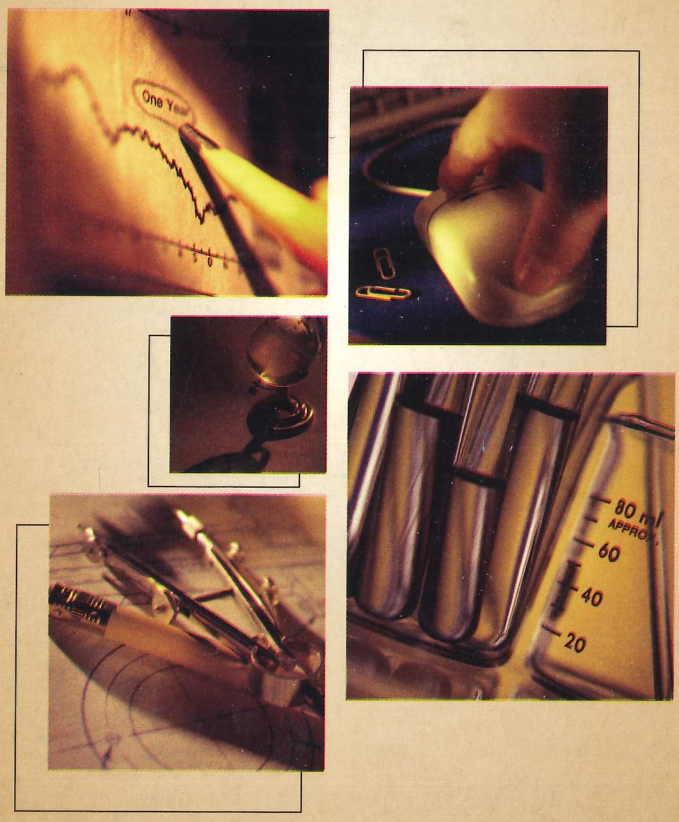

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Foreword

We are proud to introduce the 5th Edition of the *Journal of Student Research*. The *Journal of Student Research* is part of the University of Wisconsin-Stout's effort to promote and recognize undergraduate and graduate research.

In the 5th edition, you will find articles and research projects as diverse as the degree programs at the University of Wisconsin-Stout. The Journal features research from such programs as Applied Psychology, Art and Design, Biology, Food and Nutritional Sciences, Human Development and Family Studies, Mathematics, Statistics, and Computer Science, and Training and Development.

The *Journal of Student Research* is a student led endeavor. Students play an integral role in the cover design and layout, the editing and formatting of the articles, and the physical printing of the Journal itself. Members of our faculty research advisory council review articles and provide feedback. We would like to thank everyone involved in the production of the 5th Edition of the *Journal of Student Research*.

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Responsibility: Where Does Generation Y Stand?

Nathan Beranek and Mary Butler
Undergraduate Students, Human Development and Family Studies

Keywords: Responsibility, generation Y, childhood

Abstract

Society perceives Generation Y as being irresponsible. This study investigated the attitudes of Generation Y towards the development of responsibility in childhood by surveying 20 male and female college students at the University of Wisconsin-Stout. It was hypothesized that parents and schools had the greatest impact on the development of responsibility in childhood. Survey data was statistically analyzed using frequencies and a reliability analysis. Results indicate that other factors such as birth order, teachers, and other activities were just as influential as parents in the development of responsibility. The implications of our findings are that family professionals need to become aware of the effects of other activities, in addition to schools and parents, in the development of responsibility in childhood. It is also important for members of Generation Y to become aware of their own attitudes towards their responsibility development in childhood to help remove the negative labels society has placed on them.

Introduction

A study conducted by Public Agenda found that "Most Americans say they are disappointed with kids these days" ("Kids These Days," 1999, ¶ 1). Many Americans describe teens as being lazy and irresponsible. Fewer than half of adults and only one-third of teens say the next generation will make America a better place. More people today than two years ago say that "failing to learn values such as honesty, respect, and responsibility" is the most serious problem affecting kids ("Kids These Days," 1999, ¶ 7). Only a handful of adults say it is very common to come across children or teens who are friendly, helpful, or who treat people with respect. The public holds parents fundamentally responsible for how well kids are doing. Fewer than one in four Americans say it is

common to find parents who are good role models and many people are more likely to blame parents, rather than social forces, for problems with kids ("Kids These Days," 1999, ¶ 8). After doing some initial research, we came to wonder why society views our generation as irresponsible. It seems as if society holds parents and schools accountable for our perceived irresponsibility. However, we are going to investigate this question by asking, "What are University of Wisconsin–Stout students' attitudes towards the development of their own sense of responsibility in childhood?" For the purpose of this study, responsibility is "The quality or state of being responsible as a moral, legal, or mental accountability," as defined by Merriam-Webster's Online dictionary (2005). Generation Y is defined by www.answers.com (2005) as, "being born between the years of 1977 to 1994."

Literature Review

In terms of our research question on the development of responsibility, we were unable to locate a study that attempts to explain how responsibility is developed from the viewpoint of adults. Our four articles explain what responsibility is and how responsibility is developed in childhood. Such and Walker (2004) wrote about children's understanding of their own responsibility. Parents are assumed to take responsibility for children's happiness. De Ruyter (2002) discusses the meaning of responsibility and how responsibility is taught throughout life. He states that responsibility means answerable or accountable. A responsible person is a person who is accountable to his or herself to others for what he or she has done. Cook and Douglas (1998) help to explain the formation of your sense of self using Symbolic Interaction Theory. They use the term "looking glass self" to describe the development of one's sense of self. The article explains that your sense of self is formed through how others view you and your perception of their views. Hwang (1995) addresses parents pushing the teaching of responsibility onto the school systems. Since the children are not coming into school with a foundation that includes responsibility, they are at an immediate disadvantage. This article states that parents are failing to instill responsibility and are leaving it up to the school system.

Theoretical Framework

We will be using Symbolic Interaction Theory to help explain the formation of responsibility in people's lives. Symbolic interactionists believe that how people view themselves is determined by how

significant others view them, that is, people observe how they are viewed by significant others and construct their self image from these observations. Our generation is perceived as focusing on our sense of self rather than maintaining the responsibilities of our family role. This perceived misinterpretation of Generation Y is the basis of our research problem. By surveying UW-Stout students and determining their attitudes towards the development of their sense of responsibility in childhood, we are hoping to be able to compare our findings to the societal perception of Generation Y. Our hypothesis is that students will express that parents and school had the most influence on their development of responsibility. This hypothesis is based on our literature and theoretical framework.

Purpose

The purpose of this study will be to examine the opinions of UW-Stout students to find out their attitudes towards their development of responsibility in childhood. It is our hope that the results of our study can determine how responsibility of UW-Stout students that are members of Generation Y was developed. By surveying a portion of Generation Y, we will be able to determine how they feel about their sense of responsibility and how they perceive its development.

Methods

Participants

We used our survey to sample a small section of UW-Stout students that are a part of Generation Y. For the purpose of this study, Generation Y was defined as any individual born between the years of 1977 through 1994. We were able to generalize the results onto the greater population of Generation Y. Our research team surveyed fifty people; through randomization we analyzed twenty of the fifty surveys. Because of our randomization our results are more likely to be accurate when generalized to the larger population of Generation Y.

Research Design

The population used for this research study was the student campus population at the University of Wisconsin – Stout. The quota method of sampling was used. Quota method sampling is selecting respondents from a location convenient to the researcher and based on a characteristic that is driven by the research question. Whenever a person with a visible relevant characteristic is seen, that person is asked to

participate in the study until the researcher has acquired the required number of participants.

Data Collection Instrument

Our instrument was designed by our research team to help assess the attitudes of college students towards their development of responsibility. We constructed a survey that contained five close-ended statements to help assess what social environments were instrumental in forming their sense of responsibility in childhood. For the purpose of this study, we defined childhood as any time between birth and young adulthood (0-18yrs). The survey utilized a Likert scale. This scale placed different respondents in relation to each other in terms of their intensity of their attitude toward an issue based on a categorical scale ranging from strongly disagree (1) to strongly agree (5).

The University of Wisconsin – Stout students in this study were asked to report their academic status, gender, and birth order on a paper-and-pencil survey. The forms of questions on the survey were developed as a result of reading the literature and choosing a theory that fit with the research question.

Two types of validity were assessed: face validity and content validity. Face validity implies that each statement on the scale has a logical link with the concept in question that spoke to the overall research question. Regarding content validity, the statements had to cover the full range of the concept in question, in this case, UW-Stout students' attitudes toward development of responsibility. Content validity was judged on the basis of the extent to which the statements represented the issue they were supposed to measure (use of the literature, prior research and piloting the instruments).

Prior to distributing the survey, we reviewed our survey with our research supervisor. After making the necessary changes suggested by our research supervisor, we proceeded with the distribution of our survey.

Procedure

During the week of October 25, 2005, our research team collected the data by walking through six UW-Stout classroom buildings and distributing our survey to willing participants. After agreeing to participate, the participants received our survey. Respondents were instructed to respond to five statements by circling the number that best represents their attitudes towards their development of

responsibility in childhood. Each survey was completed in the presence of the research team.

Upon collecting all of our completed surveys, we cleaned and randomized the surveys. Surveys were cleaned if they had any missing data or the participants indicated that they were an only child. We determined they were an only child because they were not able to answer our question discussing birth order. We did not include these surveys as part of our sample. Another way in which we randomized our survey was that we randomly put our clean surveys in a pile. We then took every third survey from the cleaned pile. The newly formed pile of randomly selected cleaned surveys was our final sample.

Data Analysis Plan

The research team assigned a participant number to each cleaned survey. We then developed a codebook, a set of rules for assigning numerical values to answers obtained from participants. A variable name and numerical value was assigned to each of the categories and responses on the survey. Each cleaned survey was then coded accordingly.

For each of the statements on the survey, a variable name was also assigned by the research team based on the main concept of college student's attitudes towards the development of responsibility. We assigned (PAR) for parents played a role in the development of responsibility, (BOR) for birth order played a role in the development of responsibility, (SCH) for school attendance played a role in the development of responsibility, (TEA) for teachers played a role in the development of responsibility and (OA) for other activities played a role in the development of responsibility.

To analyze the data, the research team used the Statistical Package for the Social Sciences (SPSS), a statistical computer package where the level of analysis in this study was the individual. One of the first steps in any data analysis is to perform a frequency distribution and detect missing data. Frequencies displayed the range of values for each variable and ascertained how many participants responded to each variable and the strength of each response. For example, the research team assigned the number 1 for strongly disagree, 2 for disagree, 3 for undecided, 4 for agree and 5 for strongly agree. We also conducted a reliability analysis to ensure our statements were a reliable measure of our overall concept of responsibility.

Results

Our frequency distributions were run on the variables: PAR, BOR, SCH, TEA and OA. Ninety percent of our participants agreed or strongly agreed to the statement, "My parents played a role in the development of responsibility in childhood (PAR)." Ninety percent of our participants agreed or strongly agreed to the statement, "Other activities I was involved in played a role in the development of responsibility in childhood (OA)." Ten percent of our participants were undecided. Seventy-five percent of our participants agreed or strongly agreed to the statement, "Attending school played a role in the development of responsibility in childhood (SCH)." Sixty percent of our participants agreed or strongly agreed to the statement, "Birth order played a role in the development of responsibility in childhood (BOR)." Fifty-five percent of our participants agreed or strongly agreed to the statement, "Teachers played a role in the development of responsibility in childhood (TEA)."

A reliability analysis was performed to indicate if our five variables (PAR, BOR, SCH, TEA and OA) were a reliable index to measure our major concept of UW-Stout students' attitudes towards responsibility development in childhood. Cronbach's Alpha is a method used to measure reliability in survey questions. Our Cronbach's Alpha analysis score was .644. This value indicates that overall our survey items are a reliable index of measuring our major concept of attitudes of UW-Stout students' attitudes towards responsibility development in childhood.

Discussion

This study's findings supported the original hypothesis that parents and schools would be the major contributors to the development of responsibility during childhood. Since our literature or theory did not reference other activities (other activities: jobs, sports, religion, etc.) in any way, we did not hypothesize about them. However, our research has unveiled that students feel other activities played as big a role as parents in their development of responsibility in childhood. Ninety percent of students surveyed agreed or strongly agreed to our survey statement discussing other activities. This part of our results sheds new light on prior research done on the concept of responsibility development.

The findings of this research suggest that parents and other activities (i.e., job, sports, religion, etc.) are the biggest influences on the development of responsibility in childhood. This is inconsistent with findings in the literature. According to the literature parents are said to

pass the task of responsibility development onto schools and teachers. However, our research suggests that parents have a strong influence on the development of responsibility in childhood. Such and Walker (2004) discuss that family support and care are very important in a child's development of responsibility. They state that children's and parent's responsibilities contribute to the functioning of the household. Children feel that being responsible is a facet of individuality that was socially and internally negotiated. Also doing things responsibly and doing responsible things are a start to the development of power and autonomy. We found that parents and school attendance are the two primary factors in the development of responsibility in childhood.

Cook and Douglas (1998) explain that the foundation of the Symbolic Interaction Theory lies between fulfilling your role while at the same time maintaining your sense of self. Parents have a set of expectations of each member of the family that they require for the family to function. The way one meets these expectations determines his or her role. Symbolic Interaction Theory applies to schools as it does the parents; when children are at school, teachers act as their parents.

Limitations

The first major limitation of our research was the fact that we were limited to surveying University of Wisconsin–Stout students. If we would have been able to conduct our research with a larger survey sample size, we would have had a more diverse respondent base. Along with a limited population, time was also a major limitation. We only had a semester in which to conduct our research. Because of varying student schedules, the availability to find willing participants was limited to the time between classes in classroom buildings, the student center, and the library.

Implications for future research

Overall, this research adds to the body of knowledge in the area of the development of responsibility in childhood. It presents information on the influences of the development of responsibility on members of Generation Y. This study has several implications for future research. Our research suggests that schools are having a great influence on the development of responsibility in childhood on members of Generation Y. Taking into account the various activities one has in his or her life could be linked to the amount of responsibility one shows. It is difficult to determine the definition of what the participants deemed as other

activities. This could be an area to be studied by future researchers. An additional possibility for future research on the topic of responsibility could be directed at an older age population. This way one could investigate how this Generation views themselves and compare the results to that of Generation Y.

Conclusion

Through this research, we have shed new light on the importance of other activities and hope that more research is done in the area of responsibility development. In addition, this research will inform the students of the University of Wisconsin–Stout and other universities on this particular subject. We have found that members of Generation Y find themselves to be responsible and had strong influences on the development of their responsibility.

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Table 1

Frequencies of Variables

Variable	Responses				
	Freshman	Sophomore	Junior	Senior	Total
STAT	10%	5%	30%	55%	100%
	Male	Female	Other		Total
GEN	30%	70%	0%		100%
	Oldest	Middle	Youngest		Total
BO	55%	30%	15%		100%

Note. Frequencies of Status in School (STAT); Gender (GEN); Birth Order (BO); My Parents Played a Role in the Development of my Responsibility in Childhood (PAR).

Table 2

Frequencies of Variables

Variable	Response					
	SD	D	U	A	SA	Total
PAR	0%	0%	10%	15%	75%	100%
	SD	D	U	A	SA	Total
BOR	0%	10%	30%	40%	20%	100%
	SD	D	U	A	SA	Total
SCH	0%	5%	20%	25%	50%	100%
	SD	D	U	A	SA	Total
TEA	0%	5%	40%	25%	30%	100%
	SD	D	U	A	SA	Total
OA	0%	0%	10%	35%	55%	100%

Note. My Birth Order Played a Role in the Development of my Responsibility in Childhood (BOR); Attending School K-12 Played a Role in the Development of my Responsibility in Childhood (SCH); My Teachers Played a Role in the Development of my Responsibility in Childhood (TEA); Other Activities (Jobs, Sports, Religion, etc.) Played a Role in the Development of my Responsibility in Childhood (OA).

Iris Recognition: A General Overview

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Key word: Iris recognition, iris uniqueness, wavelets, statistical independence, Hamming distance, iris recognition applications

Abstract

This article reviewed the literature regarding iris recognition. Theprocess of iris recognition is discussed in the context of the mathematical principles that underlie this procedure. Possible applications for iris recognition are explored.

Introduction

Iris recognition is not a new idea but has only been available in practical application for the last 10 to 15 years. This idea has been featured in many science fiction movies but until recently was just a theoretical concept. Iris recognition is used for security purposes and is an almost foolproof entry-level access security means because of its ability to readily identify false irises (Henahan, 2002, ¶ 8). It has not been widely used because of the cost, but has applications that are ever increasing. Iris recognition will be a viable option for any security system in the future.

Iris recognition is a biometric that depends on the uniqueness of the iris. The iris is a unique organ that is composed of pigmented vessels and ligaments forming unique linear marks, slight ridges, grooves, furrows, vasculature, and other similar features and marks (Daugman, 2003a). Comparing more features of the iris increases the likelihood of uniqueness. Since more features are being measured, it is less probable for two irises to match. Another benefit of using the iris is its stability. The iris remains stable for a lifetime because it is not subjected to the environment, as it is protected by the cornea and aqueous humor.

The process of iris recognition is complex. It begins by scanning a person's iris (Henahan, 2002, ¶ 6). The individual stares into a camera for at least a second allowing the camera to scan their iris. An algorithm

processes the digital image created by the camera to locate the iris. Once the iris has been located, another algorithm encodes the iris into a phase code that is the 2048-bit binary representation of an iris (Daugman, 2003b). The phase code is then compared with a database of phase codes looking for a match. On a 300 MHz Sun Microsystems processor more than 100,000 iris codes can be compared in a second (Daugman, 2003a). In a matter of a few seconds an individual can have his/her eyes scanned and matched to an iris code in a database identifying the individual.

The Uniqueness of the Iris

How can we be sure the iris is unique? In analyzing the iris there must be bits of an iris phase code that are statistically independent. Statistically independent means an event's likelihood of occurrence is equally probable regardless of the outcome of a given event (Larsen & Marx, 2001). The statistical independence of an iris can be determined by using the Boolean Exclusive-Or, XOR, and AND operators on the iris phase bits of any two patterns (Daugman, 2003b). XOR is a bit comparison operator that that will return 0 when comparing like bits and otherwise returns 1. AND is also a bit comparison operator that will return 1 only when comparing bits that are both 1. The XOR operation shows how the two iris patterns differ, and the AND operation eliminates the effects of background noise in the image. The combination of the XOR operator with the AND operator to normalize the result produces a fractional Hamming distance.

A fractional Hamming distance is used to quantify the difference between iris patterns. The Hamming distance of two vectors is the number of components in which the vectors differ in a particular vector space (Gallian, 2002). In this instance, the fractional Hamming distance will always be between 0 and 1. For iris patterns, the Hamming distance should theoretically be 0.500 because a bit has an equally likely chance of being 0 or 1 (Daugman, 2003b). Dr. John Daugman, a professor at Cambridge University, analyzed the Hamming distances by comparing over 4250 iris images. He found the distribution of Hamming distances to be a perfect binomial distribution with a mean of 0.499 and a standard deviation of 0.0317. A binomial distribution is a model based on a series of trials that have two possible outcomes (Larsen & Marx, 2001). The mean is the average of all measured values, while the standard deviation is amount that the values tend to vary from the mean. The observed maximum value was 0.664, and the observed minimum value was 0.334. This means that it highly unlikely for two different irises to agree in

more than two thirds of their phase bits. By a simple calculation, the degrees-of-freedom of the distribution is 249. This demonstrates that of the 2048 bits, only a small number are mutually independent due to corresponding radial components that exist within an iris. These findings demonstrate the uniqueness of an iris using the Hamming distance as a measurement.

Are the irises of two people with the same genetic makeup distinguishable? This is an important question because it would demonstrate a possible pitfall in this biometric. This condition hinders DNA testing because identical twins, twins from the same embryo, yield the same results in a DNA test. Any given person has a genetically identical pair of left and right irises that can be compared (Daugman & Downing, 2001). In a similar analysis done by Daugman, 648 iris images from 324 people were subjected to the same conditions used to render a Hamming distance (2004). The mean and standard deviation for this analysis were 0.497 and 0.031, respectively. This study was repeated with the irises from identical twins and yielded a similar result. These studies show that an individual has two unique irises, and a pair of twins has four unique irises. Thus, an iris image is independent of an identical genetic makeup.

Locating the Iris

The iris is captured in an image by a camera. The camera needs to be able to photograph a picture in the 700 to 900 nanometers range so that it will not be detected by the person's iris during imaging (Daugman, 2003b). The camera may or may not have a wide-angle lens yielding a higher resolution, but in either case a mirror is used to utilize feedback for the image. These conditions must be met in order for the iris image to have the necessary 50-pixel minimum size of the iris radius.

Once the image of the iris is obtained, the iris needs to be located within the image. There are three variables within the image that are needed to fully locate the iris: the center coordinates, the iris radius, and the pupil radius (Daugman, 2003b). An algorithm determines the maximum contour integral derivatives using the three variables to define a path of contour integration for each of the variables. The complex analysis of the algorithm finds the contour paths defining the outer and inner circumferences of the iris. Statistical estimation changes the circular paths of the integral derivatives to arc-shaped paths that best fit both iris boundaries.

Encoding the Iris Image

Once the iris has been located, it must be encoded into an iris phase code. The iris image is encoded using two-dimensional Gabor wavelets (Daugman, 2003a). A wavelet is a correspondence to a signal in waveform of a finite length (Wavelet, 2005, ¶ 2). A wavelet transform may be used to complile raw data, like an image, and encode it into a compressed file. This application can be used directly in iris recognition for the encoding process. Daugman uses wavelets to create more than two thousand phase bits from a raw image in a dimensionless polar coordinate system (2004). The system is dimensionless to allow for more flexibility when comparing iris images of different size and quality. Polar coordinates are used because they represent these curves in a simpler way compared to other coordinate systems. Each bit is determined by its phasor coordinates to minimize the impacts of errors. Masking bits are also used to minimize the effects of eyelids, eyelashes, contacts, and other hindrances. The use of phase coordinates makes the encoding resilient to out-of-focus images because it prevents all out-of-focus irises from looking similar, as is the case with facial recognition.

Once the iris has been encoded, it can then be compared to any other iris encoding. With comparison algorithms, an iris mapping can be compared to more than 100,000 different irises within a second on a 300 MHz Sun workstation (Daugman, 2004). As computer speeds increase, the number of comparisons will only increase and make the process faster. The process is completed and a match is found in only a matter of seconds, making it very efficient.

Matching Iris Codes

The question remains, what constitutes a match? Specifically, the number of iris phase bits that need to correspond for a match must be determined (Daugman, 2004). The number of phase bits required for a match is decided based on the specific application regarding how many irises need to be compared. Irises need to be matched regardless of their size, position, or orientation. This is accomplished by placing the image into a dimensionless polar coordinate system. Since the inner to outer boundary range of the iris is defined to be the unit interval, the pupil dilation and location becomes invariant. The criteria used to decide if iris codes match is called the Hamming distance criterion, which is the integration of the density function raised to the power of the number of independent tests. A density function is the sum of all probabilities of a possible outcome given a random variable, which in this case is the Hamming distance of an iris phase code. A smaller criterion results in an exponentially decreasing chance of having a false match. This allows

the strictness of matching irises to easily change for the particular application. A Hamming distance criterion of 0.26 gives the odds of a false match of 1 in 10 trillion, while a criterion of 0.32 gives the odds of 1 in 26 million. The numeric values of 0.26 and 0.32 represent the fractional amount that two iris codes can differ while still being considered a match in their respective instances.

Applications for Iris Recognition

Iris recognition has tremendous potential for security in any field. The iris is extremely unique and cannot be artificially impersonated by a photograph (Daugman, 2003). This enables security to be able to restrict access to specific individuals. An iris is an internal organ making it immune to environmental effects. Since an iris does not change over the course of a lifetime, once an iris is encoded it does not need to be updated. The only drawback to iris recognition as a security installment is its price, which will only decrease as it becomes more widely used.

A recent application of iris recognition has been in the transportation industry, most notably airline travel. The security advantages given by iris recognition software have a strong potential to fix problems in transportation (Breault, 2005). Its most widely publicized use is in airport security. IBM and the Schiphol Group engaged in a joint venture to create a product that uses iris recognition to allow passengers to bypass airport security (IBM, 2002, ¶ 5). This product is already being used in Amsterdam. A similar product has been installed in London's Heathrow, New York's JFK, and Washington's Dulles airports (Airport, 2002, ¶ 2 & 3). These machines expedite the process of passengers going through airport security, allowing the airports to run more efficiently. Iris recognition is also used for immigration clearance, airline crew security clearance, airport employee access to restricted areas, and as means of screening arriving passengers for a list of expelled persons from a nation (Daugman, 2005). This technology is in place in the United States, Great Britain, Germany, Canada, Japan, Italy, and the United Arab Emirates.

Conclusion

Iris recognition has proven to be a very useful and versatile security measure. It is a quick and accurate way of identifying an individual with no room for human error. Iris recognition is widely used in the transportation industry and can have many applications in other fields where security is necessary. Its use has been successful with little to no exception, and iris recognition will prove to be a widely used security measure in the future.

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Molecular Analysis of Grasshopper Populations to aid in Prairie Restoration Efforts

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Keywords: Prairie restoration, red-legged grasshoppers, Melanoplus femurrubrum, molecular analyses

Abstract

Although the Wisconsin Department of Natural Resources and non-government organizations have invested heavily in prairie restoration over the past decade, little effort had been made to evaluate whether insect species that inhabit these projects are also restored to pre-settlement diversity. To evaluate the effect of prairie restoration attempts on insect species diversity, eighty individual red-legged grasshoppers, Melanoplus femurrubrum (DeGeer), were collected from 7 populations in 3 relic and 4 restored grasslands. Molecular analyses were designed to obtain gene sequence data by polymerase chain reactions (PCR) amplification and sequencing the mitochondrial genes cytochrome oxidase subunit I (COI) and cytochrome B (cytB). Sixty eight M. femurrubrum sequences obtained for COI and fifty seven cytochrome b sequences were aligned and compared. These data may ultimately be used to improve the management of relic and restored grasslands.

Introduction

The last 150 years has proven devastating to the prairie ecosystems in the State of Wisconsin. Today, less than 0.1 percent of the original 2.1 million acres remains (Henderson & Sample, 1995). The Wisconsin Department of Natural Resources and other non-government agencies have been attempting to restore damaged lands back to their original prairie state. A prairie restoration is referred to "the purposeful assembly of plant and animal communities in order to reconstruct a stable ecosystem that is compositionally and functionally similar to that which originally existed" (Robertson, pg. 1, 2004). Unfortunately, restoring degraded lands has proven to be a difficult task. Traditionally,

success is measured by surveying plant species diversity within the reconstructed prairie (Westman, 1991) and comparing it to similar, intact, relic prairies. However, surveying plants omits mobile organisms such as insects, small mammals, and microbial species. We would like to assess the use of relatively mobile organisms such as M. femurrubrum to provide further comparison between reconstructed and relic prairies.

To further restoration efforts, grasshoppers can be used as a molecular tool to evaluate prairie authenticity. In a recent guide to the grasshoppers of Wisconsin, Kirk and Bomar (2005), demonstrate that *Melanoplus Femurrubrum* is a grasshopper that enjoys a widespread distribution (Fig.1). Studying grasshopper populations will help us to evaluate the quality of remnant prairies (Bomar, 2001; Bomar & Secrist, 2002) and the relative success or failure of the reconstruction.

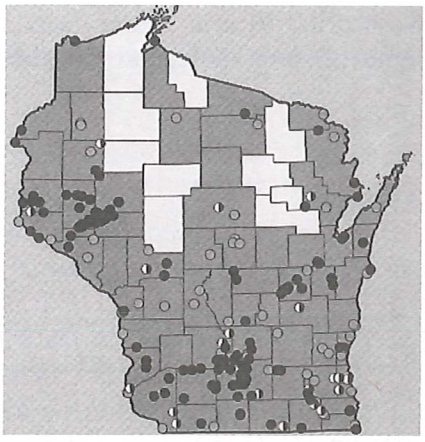

Figure 1. *M. femurrubrum* Accounts (Kirk and Bomar, 2005)

Recent literature has shown that small, isolated populations of grasshopper species can be genetically distinct (Knowles 2001 a, b; Chapco & Litzenberger 2002 a, b; Chapco, Kuperus, & Litzenberger, 1999) as well as morphologically unique (Lockwood, 1989; Chapco & Litzenberger 2002b). However, these studies focus on long time spans, such as Pleistocene glaciations (i.e. within the last 2 Myr) (Knowles & Otte, 2000; Knowles, 2001) as a source of genetic isolation of sibling species and subsequent speciation. We are interested in evaluating more recent ecological events (ca. 150 years) and their impact on genetic deviations within *M. femurrubrum*. Moreover, individuals in the field of orthopteran taxonomy have stated "...those relationships are unlikely to be resolved through the use of gross morphological characters such as those employed to date. Almost certainly it will be necessary to use molecular traits to group them properly" (Perez-Gelabert & Otte, 2000, p. 129).

In this study, we share the development of methods to obtain mitochondrial gene sequences to assess *M. femurrbrum* populations in restored and relic prairies. Since mitochondrial genes are highly conserved, show no recombination, and change slowly (Simon et al.,

1994), comparison of these sequences allow the inference of evolutionary relationships between organisms. Ultimately, these data will be utilized to construct evolutionary trees and compare diversity of grasshopper species in relic and restored prairies.

Methodology

Specimen collection.

Eighty grasshoppers were collected from restored and relic prairies previously described by Bomar (2001) and hayfields from West-Central Wisconsin. At least five males and five females were collected from seven locations (3 restored, 3 relic prairies, and 1 hayfield). Specimens were stored in -20°C after collection to preserve DNA integrity.

Muscle Dissection and DNA Extraction.

Specimens were pinned and labeled as museum specimens. One hind femur was removed from each specimen and muscle tissue rich in mitochondrial DNA was aseptically extracted from each femur. To prevent the chitinous exoskeleton from interfering with DNA polymerase during polymerase chain reaction (PCR) amplification, a forceps and scalpel were used to isolate only femoral muscle tissue. DNA was extracted from the muscle tissue using the MoBio Laboratories, Inc. UltraClean™ soil DNA isolation kit (Solana Beach, CA). DNA was concentrated 5X in a centrifugal evaporator (Speed-Vac, Thermo Savant, Waltham, MA). DNA size and quantity was estimated by 1% agarose gel electrophoresis. DNA extracted directly from the muscle tissue samples was used as a template for PCR and analyzed by gene sequencing as described below.

Mitochondrial gene amplification and cleaning for sequencing.

Custom PCR primers were synthesized by SIGMA Genosys (The Woodlands, TX). Primers for COI were previously described by Simon et al. (1994) (L2N.3014 and CI3.1718). Primers CB9 and CB10 for *cyt*B (Chapco et al., 1997, 1999) were synthesized by IDT Oligonucleotides (Coralville, IA), PCR enzymes and reagents were obtained from Amersham Biosciences (puReTaq Ready-To-Go PCR beads). Amplification conditions were modified from Chapco et al. (1999) and Knowles (2001a,b). The amplification mix included 1X TAE buffer, 10 pmol each primer, 1.0 mg/ml bovine serum albumin (Promega, Madison, WI), 1 Ìl of the DNA template, nano-pure de-ionized water (DEPC treated) (Fisher Scientific) and ~2.5 U puReTaq™ DNA Polymerase

(PCR-Ready-To-Go, Amersham Biosciences). The amplification reaction for COI consisted of an initial denaturation step of 2 min at 94°C, followed by 12 s at 94°C, 12 s at 58°C, 72°C for 55 s, and 72°C for 7 minutes. The amplification reaction for cytB consisted of (the first ten cycles) an initial denaturation step of 2 min and 12 s at 94°C, followed by a 0.5°C ramp per cycle for 10 cycles of 56°C for 12 s, and 72°C for 55 s. After the first ten cycles the reaction consisted of 12 s at 94°C, 61°C for 12 s, 72°C for 55 s, and a final extension of 72°C for 7 minutes.

DNA Purification and Quantification.

Following amplification, the mitochondrial DNA was cleaned of excess primers, nucleotides, and DNA polymerase using the Wizard® SV Gel and PCR Clean-up System, (Promega Corp, Madison, WI). Relative abundance and approximate size of the PCR product was determined by 1% agarose gel electrophoresis. Spectrophotometry was performed at wavelengths of 260nm, 280nm, and 360nm on purified mitochondrial DNA to determine an average DNA concentration for COI. Concentrations for *cyt*B were determined through template dilutions in ethidium bromide-agarose plate flourometry (Winfrey, Rott, & Wortman, 1997).

Mitochondrial gene sequencing

Purified mitochondrial DNA amplicons were sent to UW-Madison Biotechnology Center Sequencing Facility for sequencing reactions. PCR products were sequenced in both the forward and reverse directions using BigDye Terminator v. 3.1 mix (Applied Biosystems) sequencing reactions and an Applied Biosystems 3730xl automated DNA sequencer. The forward and reverse PCR primers were used as primers for the sequencing reactions.

Sequence Analysis

To confirm primer specificity of COI and *cyt*B amplification, a Blastn search (Altschul, Gish, Miller, Myers, & Lipman, 1990) was conducted using a sequenced gene. The search compares a nucleotide query sequence against a nucleotide sequence database in the National Center for Biotechnology Information (NCBI) database and generated closely matching sequences ranked by sequence score or degree of similarity. Sequences were trimmed of non-reportable base pairs at the beginning and end of the sequences, reverse compliments were created, forward and reverse sequences were joined, complete sequences were assembled and edited of ambiguities (IUPAC, 1985), and all sequences were aligned

using a sequence alignment editor (Hall, 1998). During final sequence alignment the genus *Melanoplus* and other grasshopper COI and *cyt*B gene sequences were downloaded from Genbank (Benson et. al., 2000) and used to compare sequences from the *Melanoplus* genus and *M. femurrubrum* DNA sequences (AF228996, AF229004).

Results

By comparison to a 50 bp ladder, the length of the COI band was roughly 780 bp (Figure 2) and the length of *cyt*B band was roughly 300 bp (Figure 3), corresponding to predicted lengths of the PCR products. Following amplification, mitochondrial DNA quantified by spectrophotometry yielded concentrations of 55 ng/µl or 13 ng/bp for COI. Flourometry yielded *cyt*B concentrations of 1-2 ng/µl.

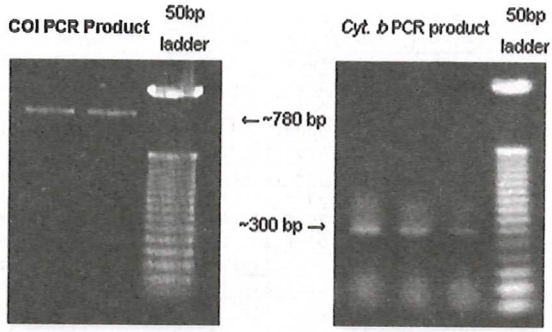

Figure 2, 3. Gel electrophoresis results for PCR amplications of mitochondial genes COI and *cyt*b aside a 50bp DNA step ladder.

Of the eighty specimens collected, sequenceable mitochondrial DNA was extracted from sixty-eight COI and fifty-seven cytB specimens. Mitochondrial DNA was sequenced as observed in the chromatogram of COI and each nucleotide was able to be identified and color-coded accordingly (Figure 4).

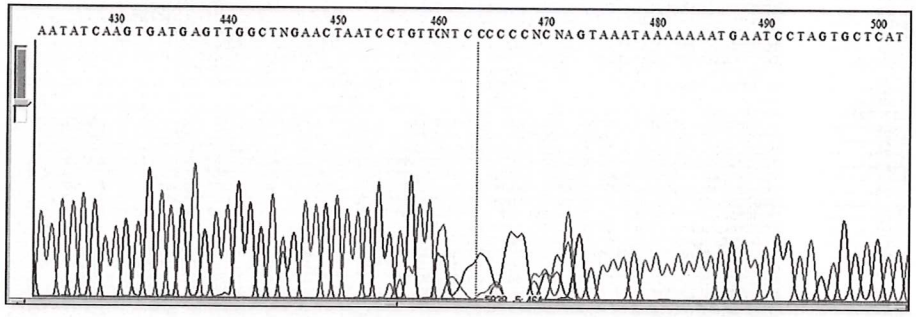

Figure 4. Chromatogram of COI sequence

Sequences were compared to database sequences during a BLASTn search. Our sequences were most similar to M. femurrubrum COI sequences in GenBank (Figure 5). During sequence analysis, DNA sequences were aligned so each sequence started at the same nucleotide allowing for further analysis (Figure 6).

Sequences producing significant alignments:		Score (Bits)	E Value
gi|11464663|gb|AF228994.1|AF228994	Melanoplus femurrubrum cyt...	1265	0.0
gi|11464657|gb|AF228991.1|AF228991	Melanoplus pinicola haplot...	1164	0.0
gi|11464659|gb|AF228992.1|AF228992	Melanoplus dawsoni cytochr...	1160	0.0
gi|11464661|gb|AF228993.1|AF228993	Melanoplus huroni cytochro...	1154	0.0
gi|11464694|gb|AF229009.1|AF229009	Melanoplus artemisiae cyto...	1116	0.0
gi|11464692|gb|AF229008.1|AF229008	Melanoplus pinicola haplot...	1114	0.0
gi|11464690|gb|AF229007.1|AF229007	Melanoplus ascensus cytoch...	1110	0.0
gi|11464667|gb|AF228996.1|AF228996	Melanoplus stupefactus hap...	1108	0.0
gi|11464681|gb|AF229003.1|AF229003	Melanoplus bivittatus cyto...	1035	0.0
gi|11464671|gb|AF228998.1|AF228998	Melanoplus femurnigrum hap...	1003	0.0
gi|11037380|gb|AF270459.1|	Melanoplus crux isolate 1025crux c...	995	0.0
gi|11464688|gb|AF229006.1|AF229006	Melanoplus lakinus haploty...	993	0.0
gi|11464665|gb|AF228995.1|AF228995	Melanoplus stupefactus hap...	993	0.0
gi|11464683|gb|AF229004.1|AF229004	Melanoplus lakinus haploty...	967	0.0
gi|11037388|gb|AF270463.1|	Melanoplus moyense isolate 1003.mo...	963	0.0
gi|11037360|gb|AF270449.1|	Melanoplus payetti isolate 1011pay...	961	0.0

Figure 5. BLASTn results of an M. femurrubrum COI amplicon

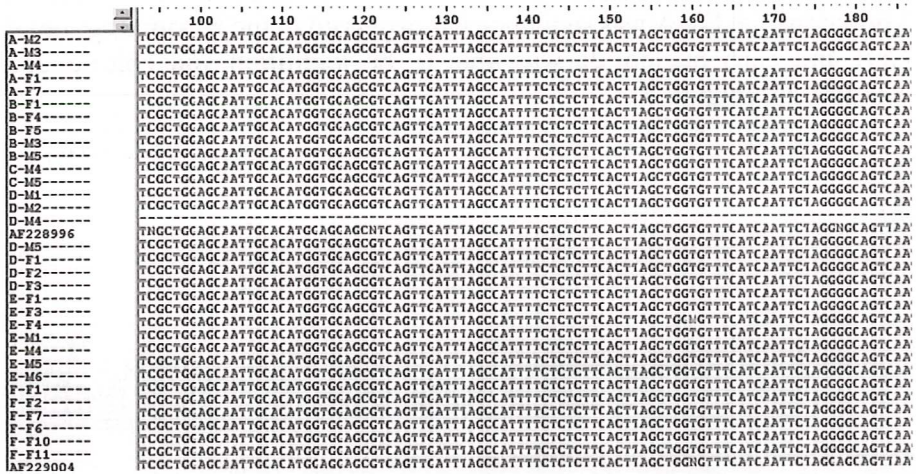

Figure 6. Sequence alignment of M. femurrubrum COI sequences

Discussion

PCR amplifications of the extracted DNA were successful (Fig. 2 and 3). The bands observed occur at the approximate base pair length expected. *Cyt*B bands are ~ 300 bp and the predicted length is ~ 258 bp. COI bands appear as 780 bp and the predicted length is 1317 bp.

The PCR amplification process proved to be a difficult task at first because chitin within the femur exoskeleton binds to DNA polymerase. This competition between the DNA and chitin was avoided by altering the DNA extraction method so no exoskeleton was used and only muscle tissue was emulsified and lysed.

After concentrating DNA through evaporation, half of the sample pool contained a significant amount of DNA for sequencing based on their bright bands in gels. Other samples had low DNA yields based on bands that were weak in intensity. To overcome this, the PCR product was re-amplified until gel bands were brighter (the brighter the band, the more products). After pooling, the COI PCR product was near the 10ng/bp needed for sequencing. Due to low quantities of PCR product for *cyt*B sequencing, all PCR amplifications were pooled and concentrated. The result was sufficient DNA for sequencing.

Overall, the sequences displayed chromatograms with very uniform peaks characterizing quality DNA and sequence reactions. After alignment of the DNA sequences, it revealed very similar sequences (Fig. 5). Sequencing also revealed some ambiguities that had to be corrected such as overlapping nucleotide peaks and others that could not be corrected (460 bp, Fig. 4). For example, when the sequencing reactions proceeded through a region rich in cytosines or guanines, the polymerase had a problem interpreting them. As a result, the peak quality in that region of the chromatogram decreased sometimes beyond analysis.

In conclusion, this research provides a molecular tool to evaluate grasshopper populations. This tool may by more beneficial when taken a step further by examining the phylogeny of *M. femurrubrum* in relic and stored prairies. These combined data may be used to improve the management of relic and restored grasslands.

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Melanoplus stupefactus haplotype 2 cytochrome oxidase subunit 1(COI) gene, partial cds; mitochondrial gene for mitochondrial product. AF228996

Melanoplus lakinus haplotype 1 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial gene for mitochondrial product. AF229004

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Functional Foods: A Comparison of Blueberry Muffin Ingredients

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Keywords: Functional foods, soymilk, flaxseed

Abstract

Functional foods have increasingly gained attention regarding their ability to reduce the onset of chronic diseases, such as cardiovascular disease. The objectives of this study were the following: 1) to evaluate blueberry muffins for protein, lipid, ash, moisture, and carbohydrate content differences when incorporating traditional ingredients compared to soymilk and flaxseed, and 2) to determine through sensory evaluation if untrained panelists could detect a difference among those blueberry muffins. Four muffins were prepared (control, soymilk, flaxseed, and soymilk/flaxseed) using a blueberry muffin mix. Sensory evaluation was performed by 107 untrained panelists among four different muffin batches. Sensory panelists were asked to rate the appearance, blueberry muffin flavor, sweetness, and the overall impression of each product on a 1 to 5 Hedonic scale rating, using 1 for dislike extremely and 5 for like extremely. Statistical analyses were determined using Statistical Package for Social Sciences (SPSS), Analysis of Variance (ANOVA) at $p<0.05$. Quantitative measurements indicated that soymilk muffins had a higher moisture (34.0%) and protein (6.42%) content, flaxseed and soymilk muffins had a higher level of ash (1.65%) and lower lipid content of 10.7%. Sensory evaluation concluded that there was no significant difference for the appearance, blueberry muffin flavor, sweetness, or the overall impression among the four different muffin types. Soymilk muffin was rated highest in appearance (3.87) and blueberry muffin flavor (3.51). Compared to the other muffins types, flaxseed muffins were rated highest in moistness (4.02). This study showed that functional foods can be incorporated into traditional food products with no discernable loss in appearance, flavor, or sweetness and the additional soy protein and minerals may assist in the prevention of the onset of chronic diseases.

Introduction

Cardiovascular diseases (CVDs) are the number one killer of Americans, responsible for approximately one million deaths per year (American Heart Association, 2005). In order to reduce the risk of CVDs, more functional foods should be incorporated into the typical American diet. A functional food is often referred to as any food that exhibits health benefits beyond the common nutrients it contains. Research has shown that functional foods, such as soy protein and flaxseed, help reduce the risk of CVD (Bloedon, 2004) and can easily be included in the diet. For example, flaxseed can be used to replace eggs in baking or cooking, which will add valuable α–linolenic acid (ALA) and soluble fiber that are important to consume since they have been found to reduce total cholesterol levels (Bloedon, 2004).

Recently, flaxseed has shown potential for CVD prevention due to its composition of ALA, soluble fibers, and lignans. These components are believed to protect the cardiovascular system by reducing serum cholesterol, platelet aggregation and inflammatory markers (Bloedon, 2004). Epidemiological data suggest that the consumption of ALA, soluble fiber, and lignans have an inverse correlation with the development of CVD. One controlled study (Jenkins, Kendall, Vidgen, Agarwal, & Rao, 1999) using 29 hypercholesterolemic adults investigated the effect of the dietary intake of wheat and de-fatted flaxseed via the consumption of muffins. After three weeks, the flaxseed muffin intervention group had a significant difference ($p<0.001$) in lowered total cholesterol levels and LDL cholesterol levels as opposed to the wheat muffin control group. This short-term study suggests that fiber and lignan components from the flaxseed incorporated into muffins helped to reduce total cholesterol levels (Bloedon, 2004). However, there was no indication as to the analysis of the protein, fat, or mineral content of the muffins, or mention of preference for the flaxseed muffins compared to traditional muffins commonly made using milk, eggs, or oil.

Soymilk, an additional functional ingredient, is rich in a class of phytochemicals called isoflavones. The most commonly occurring isoflavones in soy, diadzein, genistein, and glycitein have been found to display potent antioxidant effects such as the prevention of LDL oxidation (Murphy & Wilson, 2001). These antioxidant effects of soy are important for maintaining cardiovascular health. Since a primary cause of CVD is the build-up of plaque in arterial walls of the cardiovascular system, and any plaque taken up by the arterial walls due to oxidative damage to LDL cholesterol particles (Murphy & Wilson, 2001) can lead

to CVD, it is believed that consumption of soy products may prevent lipid oxidation, which subsequently prevents plaque buildup in arterial walls, hence inhibiting CVD.

Therefore, the objective of this study was to evaluate the protein, fat, moisture, and mineral content of traditional muffins using 2% milk and eggs compared to muffins having functional ingredients, soymilk and flaxseed incorporated, and to determine through sensory evaluation which muffin type is most acceptable.

Materials and Methods

Muffin Preparation

Four different batches of muffins (control = 2% milk, eggs, and oil; soymilk = soymilk, eggs, and oil; flaxseed = 2% milk, flaxseed, and oil; soymilk and flaxseed = soymilk, flaxseed, and oil) were prepared as follows using a purchased blueberry muffin mix (Betty Crocker Wild Blueberry, General Mills, Minneapolis, MN) for sensory evaluation and analytical testing. Control muffins were prepared by combining three-fourths cup of 2% cow's milk (Land-O-Lakes, Franklin Park, IL), one-fourth cup pure canola oil (J. M. Smucker Co., Orrville, OH), and 2 large grade A eggs (Country Creek Farms, Rogers, AZ) with the blueberry muffin mix and dropping one-third cup portions of batter into each paper lined muffin cup. The muffins were baked at 425° F for approximately 16 minutes. The soymilk muffins were prepared by combining three-fourths cup plain Silk soy milk (White Wave Inc., Boulder, CO), one-fourth cup pure canola oil, and two large grade A eggs with the blueberry muffin mix and dropping one-third cup portions of batter into each paper lined muffin cup. The muffins were baked at 425° F for approximately 16 minutes. The flaxseed batch of muffins was prepared by combining three-fourths cup of 2% cow's milk, one-fourth cup pure canola oil, 2 Tbsp. ground flaxseed (Arrowhead Mills, Hereford, TX) and 6 Tbsp. tap water with the blueberry muffin mix and dropping one-third cup portions of batter into each muffin cup. The muffins were baked at 425°F for approximately 16 minutes. The flaxseed and soy milk batch was prepared by combining three-fourths cup plain Silk soy milk, one-fourth cup pure canola oil, 2 Tbsp. ground flaxseed and 6 Tbsp. tap water with the blueberry muffin mix and dropping one-third cup portions of batter into each muffin cup. The muffins were baked at 425°F for approximately 16 minutes.

Moisture Content

Each muffin type was analyzed for total moisture content in triplicate according to the AOAC Official Method 931.04. Briefly, the muffin samples were finely ground with a coffee bean grinder to produce a homogeneous mixture for a 3 g muffin sample and were dried in an oven (Lindenburg Blue Mechanical) set at 105°C for twenty-four hours. Following drying, samples were cooled in a dessicator for one-half hour and the mass taken. Moisture content was determined by a weight difference calculation.

Ash Content

Each muffin type was analyzed for ash content in triplicate according to the AOAC Official Method 923.03 as follows. The mass was recorded for a 3g homogeneous muffin sample. The weighed samples were then placed in conditioned ash crucibles and heated in a furnace (Thermolyne 1300) set at 575°C for twenty-four hours. The samples were cooled in a dessicator for one hour and the mass dried. Ash content was determined by a weight difference calculation.

Protein Content

Each muffin type was analyzed for protein content in triplicate according to the AOAC Official Method procedure 920.87. Approximately 0.4 g of homogeneous muffin sample mass was recorded and placed in a Kjeldahl flask so that 1.6 g of Kjeldahl digestion tablet (K2SO4 + Se), 5.0 mL of sulfuric acid, and 2 Hengar granules were combined. The flask was then connected to an aspirator, heated to a boil, allowed to digest for approximately one hour, and then allowed to cool to room temperature. Next, 20.0 mL of distilled water was added to each flask. The Kjeldahl digestion flasks were connected to a distillation apparatus and a condenser tube from the distillation apparatus was placed below the surface of 50 mL of boric acid receiving solution. Blue indicator dye was added to the boric acid in the receiver adsorption flask to determine when the solution has been converted to ammonia. A layer of 20 mL of 10 M NaOH was added to the digestion flask without agitation. Two pieces of mossy zinc were added to each digestion flask to prevent bumping during the distillation process, and the contents were swirled gently to mix the two layers. The digestion flask was then connected to the condenser and heated to boiling at a temperature of 140° F until half of the solution was distilled. After the distillation was complete, the received boric acid/ammonia mixture was titrated with standardized 0.05 M HCl. The endpoint occurred when the indicator dye in the

boric acid solution turned from blue back to its original color prior to the distillation. Protein calculation content was calculated from the quantified amount of ammonia ions in the receiving solution.

Lipid Content

Each muffin type was analyzed for lipid content in triplicate. An accelerated solvent extractor (ASE 200, Dionex, Sunnyvale, CA) was used to extract total lipids of a 5 g homogenous sample. The pressure during extraction was maintained at 1,500 psi at a temperature of 105°C. Each muffin sample was placed in an extraction cartridge containing a cellulose filter pad, loaded onto the ASE, and extracted three times with 25 mL of reagent grade petroleum ether with a static duration of 10 minutes. The total extraction was 30 min./sample for 12 samples. The extract (25 mL) was evaporated under a nitrogen flow until no petroleum ether was detected. The vials were placed in a drying oven (100°C) for 30 minutes to evaporate residual solvent and transferred to a dessicator to cool for 30 minutes. The mass of the remaining lipids in the vials was used to calculate the total lipid content as a mass percentage of the original muffin mass (5 g).

Sensory Evaluation

Voluntary sensory evaluation panelists were asked to taste the four different blueberry muffin samples. Sensory panelists received a tray with each sample coded by a random 3-digit number, a cup of spring water, and a questionnaire. Panelists were given one sample at a time. The order of presenting the samples was randomized so that each sample appeared in a given position an equal number of times. Sensory panelists were asked to rate the appearance, blueberry muffin flavor, sweetness, and overall impression on a 1-5 Hedonic scale rating where 1=dislike extremely and 5=like extremely. Panelists were directed to take a sip of water between each muffin sample so that there was no carry-over taste.

Statistical Analysis

Statistical Analysis of the data was carried out using One-way Analysis of Variance (ANOVA) to determine the acceptability of the type of muffin. A significance level of $p<0.5$ and F value were considered. Statistical analysis was carried out using SPSS.

Results and Discussion

Moisture, Ash, Protein, and Lipid

Table 1 indicates the average percent values for the moisture, ash, protein, and lipid. The highest moisture content was in the soymilk muffin (34.2%), and the lowest was the flaxseed and soymilk muffin (31.6%). The average moisture content was 33.0%. The highest protein was found in the soymilk muffin (6.42%), and the lowest was in the flaxseed muffin (5.92%). The average protein content in the blueberry muffins was 6.12%. The overall ash content for all muffins was 1.62%. The flaxseed and soymilk muffin showed the highest ash content (1.65%) while the control and flaxseed muffins were the lowest (1.60%). The lipid content was highest, (14.4%) for the control muffin and lowest for the flaxseed and soymilk muffin (10.7%).

Table 1

Moisture, ash, protein and lipid (%) content in the four blueberry muffins [a]

Variable	Moisture (%)	Ash (%)	Protein (%)	Lipid (%)
Control	32.9	1.60	6.14	14.4
Soymilk	34.2	1.63	6.42	14.2
Flaxseed	33.4	1.60	5.92	10.8
Soymilk and Flaxseed	31.6	1.65	6.01	10.7
Mean (%)	33.0	1.62	6.12	12.5

Note. n=4; [a] Results are the mean percent content of moisture, ash, protein, and lipid.

Sensory Ratings

Figure 1 shows the average appearance ratings for each muffin. The panelists rated the soymilk slightly better on appearance (3.87) than the other muffins. The lowest appearance rating was the flaxseed muffin (3.61). The sensory analysis was performed under red lights to mask any color differences and consumers still preferred the appearance of the soymilk muffin compared to other muffins.

Figure 2 indicates the average flavor ratings. A similar pattern was observed, as the soymilk muffin rated significantly higher in flavor

(3.51). People liked the flavor of these muffins more compared to the other muffins. The least liked muffin flavor was flaxseed (3.00). Soymilk muffin has the highest protein content which may have contributed to the desirable muffin flavor.

Figure 3 shows the average muffin sweetness ratings. The rating pattern changed and panelists liked the sweetness of the control muffin (3.67) slightly better than the other muffins. The lowest rated muffin was flaxseed (3.25).

Figure 4 indicates the average ratings on moistness of the muffins. The panelists preferred the moistness of the flaxseed muffin more than the other types of muffins. The average value for the flaxseed moistness attribute was 4.02. The moisture content for the flaxseed muffin was 33.4% and the moisture content for the soymilk muffin was 34.2%, Interestingly, the moisture content of the flaxseed muffin was slightly lower than the soymilk muffin but higher than the average moisture content (33.0%) for the blueberry muffins. There is a correlation between the moisture content and the degree of moistness of the muffin. Higher moisture content indicates that the muffin would be moister. It is postulated that the panelists may have preferred the moderate moistness but did not like muffins that are either too dry or too moist. The control muffin with moisture content of 32.9% was the least rated in terms of moistness (3.38) and was significantly lower ($p<0.05$) than the soymilk muffin.

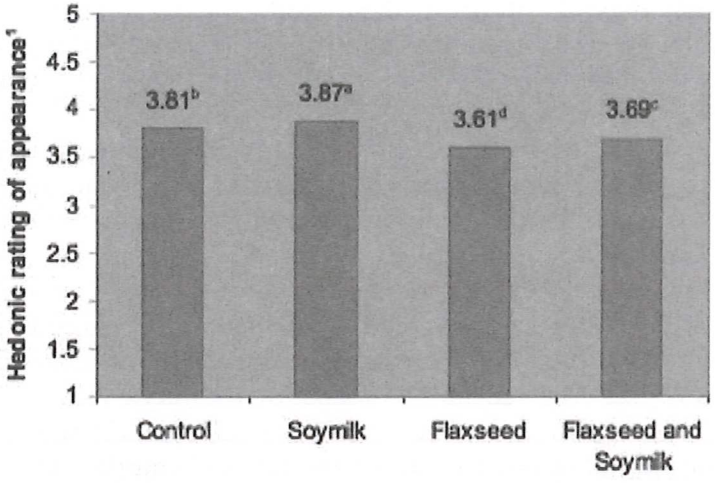

Figure 1. Average appearance rating of each Blueberry muffin

n=107; 1=Values followed by different lower cases letters are significantly different ($p<0.05$) Hedonic rating where 1=Dislike extremely, 5 =Like extremely

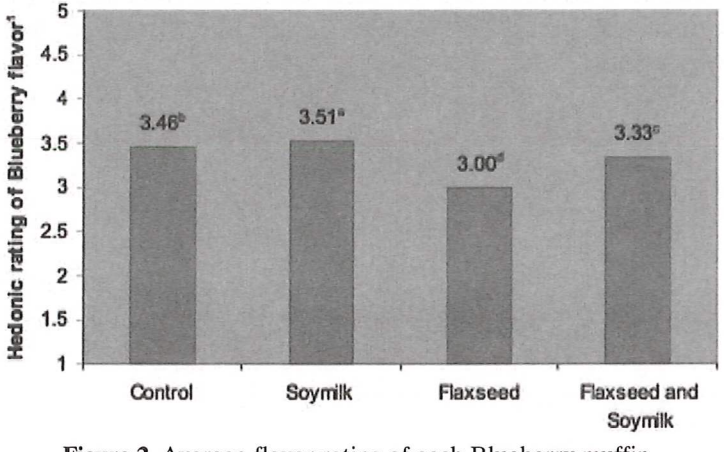

Figure 2. Average flavor rating of each Blueberry muffin

n=107; 1=Values followed by different lower cases letters are significantly different ($p<0.05$) Hedonic rating where 1=Dislike extremely, 5 =Like extremely

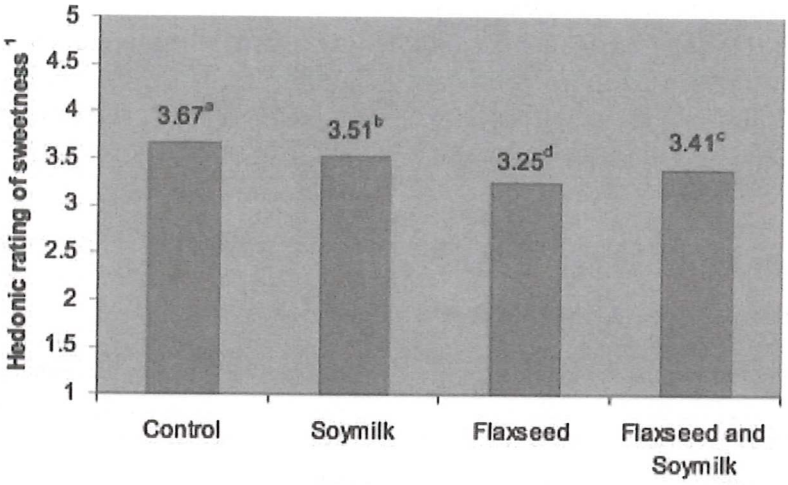

Figure 3. Average sweetness rating of each Blueberry muffin

n=107; 1=Values followed by different lower cases letters are significantly different ($p<0.05$) Hedonic rating where 1=Dislike extremely, 5 =Like extremely

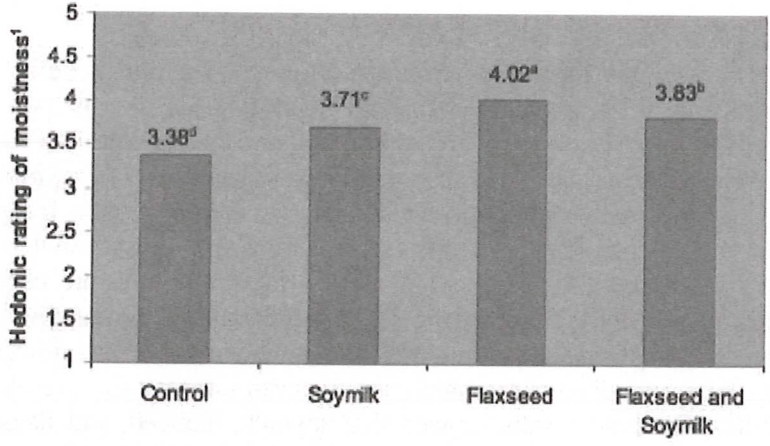

Figure 4. Average moistness rating of each Blueberry muffin

n=107; 1=Values followed by different lower cases letters are significantly different ($p<0.05$) Hedonic rating where 1=Dislike extremely, 5 =Like extremely

Overall Sensory Acceptability

The overall sensory acceptability rating results are summarized in Table 2. Overall there was no significant main effect from the sensory ratings on the four blueberry muffins (p=0.584, F =0.654). Therefore, panelists liked the four different muffins equally in terms of appearance, flavor, sweetness, and moistness.

Table 2

Overall sensory acceptability of the blueberry muffins[a]

Blueberry muffin	Average overall sensory acceptability
Control	3.58
Soymilk	3.65
Flaxseed	3.47
Flaxseed and Soymilk	3.57

n=107; [a=] Results are the mean of the four blueberry muffins overall sensory ratings. F-value=0.654, p-value =0.585

Conclusion

Much research has been conducted on the health benefits of soy protein and it is suggested that incorporating 25 grams per day of soy protein as part of a low saturated fat and cholesterol diet may reduce the risk of heart disease. In the current study it was found that the soymilk muffin had a higher protein content mostly attributed to the soy protein. It is postulated that more health benefits will be obtained if using this functional food compared to traditional ingredients (eg., whole milk). The moisture content is a strong indicator of the degree of moistness in the muffins. The panelists liked the moistness of the flaxseed muffin, which is a functional food. Therefore, incorporating these ingredients into making muffins can improve the overall sensory attributes. The lipid results showed that soymilk, flaxseed, and flaxseed and soymilk muffins had a lower fat content than the control. In addition to being functional foods, soymilk and flaxseed decreased the fat content of the muffins.

This study demonstrated that functional ingredients can be incorporated into food products with no loss in appearance, flavor, or moistness. The important benefit of soy protein and a lowered lipid content from muffins using soymilk and flaxseed supports further use of incorporating these ingredients into foods.

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The Effects of Over-Scheduled Children: Perspectives of Childcare Workers

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Key Words: Over-scheduled children, stress, day care providers

Abstract

This study used survey research to gather the University of Wisconsin-Stout Child and Family Study Center (CFSC) childcare workers' perspectives regarding the effects of over- scheduling children in Menomonie, Wisconsin. The participants in this study were eight individuals who were undergraduate students or had completed their undergraduate education and six individuals who were graduate students or who had completed their graduate education. The computer program Statistical Package for Social Sciences (SPSS) was used to statistically analyze the data by use of frequencies, cross-tabulations, and mean comparisons. Our findings indicate that childcare workers do not perceive children as being over-scheduled. Another finding was that there might have been a gap in the education on over-scheduled children for the staff of the CFSC. Future research could include duplicating this same survey in a larger and more diverse population with childcare workers and teachers.

Introduction

The phenomenon of over-scheduled children has become the wave of the new era. The concept of a carefree childhood with time for leisure play and free time is becoming less of a reality while hyper-scheduling, over-busyness, and loss of family time is becoming more of a reality for many children (LeFebvre, 2005). Children today may be spending a large fraction of time in highly structured activities, such as sports programs, church-sponsored activities, and other school-sponsored programs which leave them with little time for spending quality time with their family and doing relaxing activities such as reading (Hofferth & Sandberg, 2001). Parents likely want to give their children many opportunities to participate in numerous activities, enabling children to build skills and develop talents that would be beneficial to them as they grow into adulthood. A compressed definition of an over-scheduled child is a child who

has very little free time in which they can pursue and enjoy their hobbies or relax, but instead spend much of their time, when not in school or doing basic personal care needs (sleeping, eating and bathing), doing multiple structured activities at any given time (Hofferth & Sandberg, 2001).

Review of the Literature

After an extensive search to find information regarding children's stress levels due to being over-scheduled, very little was found. What was found were journal articles that had information on childrens' daily activities, varying types of activity and family situations, and amount of time spent doing such activities.

Bianchi and Robinson (1997) used a time-use study to see how randomly selected children spend their time throughout a given day and if there were variations depending on the family composition. The findings were that nearly 90% of children watch television daily compared to only 25% of children reading a book or being read to. It was also found that parental education influenced activities at home. A study done by Hofferth and Sandberg (2001) used time diaries that found as children age, they spend more time in school and less time in day care, especially if the mother is employed, accounting for 15% of the children's time. Structured activities consisting of church, sports, and visiting were found to be more time consuming than unstructured activities; children of working female homes were found to spend more time playing sports. According to Pellegrini and Smith (1998), there are three forms of physical activity play at different ages: infancy peaks their rhythmic stereotypes, preschool years peak their exercise play, and middle childhood peaks rough-and-tumble play. Children face greater need of good physical activity as young children turn into adolescents to gain the physical, cognitive, and social domains they will need to go throughout life. Larson and Verma (1999) concluded that children and adolescents who spend a large amount of their time on routine chores (household) will encounter a dissimilar set of socialization experiences than children who spend large amounts of their time playing or in a certain setting (school). The developmental variable has shown that the investment of one's time into education can raise an individual's lifetime earnings and at the collective level is related to the growth in the society's economy. It is important to determine if children are becoming more stressed with the increasing amount of structured activities in which they are participating.

Theoretical Framework

The theory being used in this study is Human Ecology Theory, developed by Urie Bronfenbrenner. The Human Ecology Theory indicates that individuals

develop within their own human ecology system. The four levels of environmental systems of human ecology are micro-, meso-, exo- and macro-, all of which are interdependent of one another. The micro-system encompasses the relationships and interactions a child has with his or her immediate surroundings including the following: parents, peers, close relatives, schools, childcare, and neighbors. The meso-system provides the connection between the structures of the child in the micro-system including connections with a child's day care provider and the parents. The exo-system is the larger social system which a child is not directly involved with but is affected by. This system's structures interact with the micro-system's structures, including parental workplace schedules and school curriculum. Finally, the macro-system consists of the cultural norms, broad ideological values, and laws by which we live. This system has a trickling down effect on the interactions of the other systems. If it is felt that families are solely responsible for rearing their children, then it is up to the parents to decide the style of parenting they choose involving discipline, activities, place of daycare, and which church to attend if they choose, ultimately developing the child through the areas of parental choice.

As applied to our study, this theory would predict that individuals who have been over-scheduled children throughout life may continue to be over-scheuled individuals throughout the rest of their lives. An example of the Human Ecology Theory subsystems is when a child is being over-scheduled, it may lead to the child being tired, emotionally exhausted, and/or sick. Having a sick, tired or exhausted child at home means the parent may not be able to go to work. With the mother, father or caregiver not at work, there is a loss of working hours for the employer and the individual may also lose pay. Lastly, the economy or the general culture could be hurt from the parent not a ttending work and not getting paid for the time they need to take of the child. This indicates how one over-scheduled child could hurt or harm others who are not directly involved with the individual.

Purpose

The purpose of this study was to survey UW-Stout childcare workers on their perspectives regarding the effects of parents over-scheduling their children. The results from this study will inform family service workers in educating parents on these effects in order to promote healthy children who will grow into healthy adults. Another purpose of this study was to see the effects of parents over-scheduling their children and what effect it had or has on the children's overall well being at the University of Wisconsin-Stout Childcare Center. Our research problem is that parents are over-scheduling their children and we are examining if this has a direct result on children's well being

(i.e., fatigue, illness, etc.). The central research question in the study is: What is the UW-Stout daycare workers' perspective on the effects of parents over-scheduling their children?

Methods

Participants

The site of this study was the University of Wisconsin-Stout Child and Family Study Center (CFSC) in Menomonie, Wisconsin. The participants in this study were eight individuals who are undergraduate students or have completed their undergraduate education, and six individuals who are graduate students or who have completed their graduate education. Thirteen females and one male completed the questionnaire. The participants worked a range of hours: three individuals worked zero to eight hours, four individuals worked seventeen to twenty-four hours, one individual worked twenty-four to thirty-two hours and six individuals worked thirty-three to forty hours.

Research Design

The study is represented best as a cross-sectional design because it captures the informational knowledge at one point in time. The study sample could not be randomized due to the fact that a small number of individuals worked at the center. This study may not be generalized to a larger population due to the small sample and the inability to randomize the sample population.

The data collection form the research team used was a self-administered questionnaire. The questionnaire contained a written list of closed-ended questions that were clear and easy for respondents to understand. The advantages of using the self-administered questionnaire were that it was less intimidating than face-to-face interaction interview would have been and the expenses and time commitment were minimal.

Quota sampling was used because we surveyed individuals who were easy to access. We used this sample because it is most accessible for us to gain knowledge about over-scheduled children and the effects it has on them. The research team also used purposive sampling by going directly to the University of Wisconsin-Stout daycare center staff because the research team felt the staff would have the information needed to successful obtain data about over-scheduled children.

The research team's completion of an online Human Subjects Training through the University of Wisconsin-Stout Institutional Review Board ensured the ethical protection of the participants in this study.

Data Collection Instrument

The data collection instrument was designed by our research team to address the major concept of the study. A cover letter was created for the questionnaire which included the following components: introduction of the research team and the institution the research team represented, a description of the purpose for the study along with general instructions which indicated that participation for the study was totally voluntary, and an assurance that each participant and their name were not used and participants would remain confidential.

The University of Wisconsin-Stout CFSC Day Care Staff in the study were asked to report their level of education, their gender, and the hours worked per week on a paper-and-pencil questionnaire. The formation of questions on the questionnaire was developed as a result of reading the literature and choosing a theory that fit with the research questions. In this case, Human Ecology Theory would attempt to explain that an individual develops within an ecology system. The Human Ecology Theory focuses on the interactions between humans and their natural environment. The Human Ecology Theory can help explain that being over-scheduled would affect children's physical and mental well-being as well as their functioning in other environments (school, church, community). According to Pellegrini and Smith (1998)veryday there are a number of children who face being over-scheduled who are forming cognitive disabilities. Children should be involved in these three forms of physical activity: rhythmic stereotypes, exercise play, and rough-and-tumble play. These three activity levels can be significant in not forming cognitive disabilities. Older children are better able to adapt to being over-scheduled than younger children. Children today are more involved in scheduled activities than leisure activities. Hofferth and Sandberg (2001) found that for children using diaries (written journal) on an everyday basis, recording personal information on tasks such as eating, sleeping and personal care, accounted for 55% of a child's day. According to Bianchi and Robinson (1997), the affects of childhood time usage continue to be felt in adulthood. Thus, the questionnaire in this study contained six closed-ended, positively-directed statements regarding the concept of over-scheduling.

The scale used in the questionnaire was the Likert scale. The scale placed different respondents in relation to each other in terms of the intensity of their attitude towards the issue based on a categorical scale from strongly disagree (1) to strongly agree (5).

Validity is the ability of an instrument to measure what it is designed to measure. Content and face validity were the two types of validity used in this study. Content validity indicates that the statements need to cover a full range of concepts under question, in this case, parents over-scheduling their children. Face validity ensures each of the statements on the scale needs to have a

logical link with the concept of the question that spoke to the overall research question.

Since the research team was unable to clarify the questions for the respondents, it was important to pilot the questionnaire to form an overall clarity and understanding of the statements prior to distributing the questionnaire to participants. The questionnaire was piloted to 14 University of Wisconsin-Stout CFSC Day Care Staff in the Day Center on campus.

Procedure

The research team collected data and selected a sample study of University of Wisconsin-Stout Child and Family Study Center (CFSC) Day Care Providers. The questionnaire was completed in the presence of the research team, either at the Infant/Toddler or Pre-School CFSC.

The research team contacted the director of the CFSC to gain permission to approach the staff for them to fill out the questionnaire. After receiving permission, we approached the day care staff either as the were leaving their shift or coming in for their shift of the day. After approaching the staff, we asked them if they would fill out our questionnaire. The directions instructed the staff to respond to a series of six statements by circling a number that best represented their perceptions on over-scheduled children.

Data Analysis Plan

The research team assigned a participant number to each questionnaire. In the process of cleaning the data, the research team verified that every item on every questionnaire had been answered, making sure there was no missing data. If the research team had too much missing data it would lessen the validity and likelihood of being able to generalize to the larger population; there were no missing data.

To code the data, the research team developed a codebook—a set of rules for assigning numerical values to answers obtained from participants on a clean questionnaire. For each of the statements on the questionnaire, the research team assigned a variable name. These variables were based on the main concept of over-scheduled children. The variables were as follows: PSC=parents over-scheduling children, STS=over-scheduling creates stress in children, COG=over-scheduled children are forming cognitive disabilities, AGE=older children better adapt to over-scheduling than do younger children, LES=children are more involved in scheduled than leisure activities, and TIR=children are looking more tired/fatigue driven during the day.

To analyze the data, the research team used the SPSS statistical computer package; the level of analysis was the individual. A frequency distribution was

conducted to detect missing data and to ascertain how many participants responded to each variable and the strength of each response. For example, the research team assigned the number 1 to equal strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree. The reliability analysis and Chronbach's Alpha (statistical reliability check) helped determine how reliable the statements in the questionnaire were in measuring the main concept.

Results

The variables analyzed were PSC (parents over-scheduling children: "Parents, over all, are over-scheduling their children"); STS (stress: "Over-scheduling creates stress in children"); COG (cognitive: "Children who are over-scheduled are forming cognitive disabilities"); AGE (Age of children: "Older children are better able to adapt to being over-scheduled than younger children"); LES (leisure: "Children are more involved in scheduled activities than leisure activities"); TIR (tired: "Children are looking more tired and fatigue-driven during the day"). The statistical analyses performed on these variables were frequency distribution, and reliability analysis.

All of our variables were subjected to frequency distribution analysis. The results indicated that there were no missing data. For the variable PSC, 28.6% of the respondents strongly disagreed/disagreed, 28.5% agreed/strongly agreed, and 42.9% of the respondents were undecided if parents, over-all, are over-scheduling their children. For STS, 0.0% of the participants strongly disagreed/disagreed, 7.1% were undecided, and 92.9% of them agreed/strongly agreed that over-scheduling creates stress in children, STS. The question COG returned the following results: 42.9% of the respondents strongly disagreed/disagreed, 50.0% were undecided, and 7.1% agreed/strongly agreed that children who are over-scheduled are forming cognitive disabilities. For AGE, 35.7% of the respondents strongly disagreed/disagreed, 21.4% were undecided, and 42.9% of the respondents agreed/strongly agreed that older children are better able to adapt to being over-scheduled more than younger children. For the variable LES, 21.4% of the respondents strongly disagreed/disagreed, 28.6% were undecided, and 50.0% of the participants agreed/strongly agreed that children are more involved in scheduled activities than leisure activities. Finally, for the variable TIR, 28.6% of the respondents strongly disagreed/disagreed, 28.6% were undecided, and 42.9% agreed/strongly agreed that children are looking more tired and fatigue-driven during the day.

Table 1

Frequencies

Variable	SD	D	U	A	SA	Total
PSC	0.0%	28.6%	42.9%	21.4%	7.1%	100.0%
STS	0.0%	0.0%	7.1%	50.0%	42.9%	100.0%
COG	0.0%	42.9%	50%	7.1%	0.0%	100.0%
AGE	0.0%	35.7%	21.4%	42.9%	0.0%	100.0%
LES	0.0%	21.4%	28.6%	42.9%	7.1%	100.0%
TIR	0.0%	28.6%	28.6%	42.9%	0.0%	100.0%

Note. PSC=parents over-scheduling children; STS=over-scheduling creates stress in children; COG=over-scheduled children are forming cognitive disabilities; AGE=older children better adapt to over-scheduling than do younger children; LES=children are more involved in scheduled than leisure activities; and TIR=children are looking more tired/fatigue driven during the day.

The reliability analysis was run to indicate if our six variables (PSC, STS, COG, AGE, TIR and LES) were a reliable index to measure our major concept (UW-Stout Day Care Center perception on the effects of over-scheduled children). Cronbach's Alpha is a measure of reliability, and in our analysis was .433. This value indicates that our survey items are not a reliable index of our major concept, the UW-Stout Day Care Center's perception of the effects of over-scheduled children.

Discussion

What is the University of Wisconsin-Stout Day Care workers' perspective on children being over-scheduled? The research team expected to find children being over-scheduled and what was found through the questionnaire research was that the UW-Stout day care staff did not feel the children were being over-scheduled.

The results of this study did not support the literature review. The research survey was to see if children attending the day care at the University of Wisconsin-Stout are being over-scheduled. The staff responses indicated that they were undecided whether children were being over-scheduled. The litera-

ture review stated children today may be spending a large fraction of time in highly structured activities such as sports programs, church-sponsored activities, and other school-sponsored programs which leaves little time for spending quality time with their family and doing relaxing activities such as reading (Hofferth & Sandberg, 2001). With our finding, the children at the day care center did not experience this impact. Larson and Verma (1999) concluded that it is important to find if children are becoming more and more stressed with the increasing amount of structured activities they are partaking in. We found no relationship between children being over-scheduled with the high stress levels and physical symptoms. The research team did find that the staff at the UW-Stout day care center does recognize that over-scheduling creates stress in children.

Our findings support the theory used with this study. Human Ecology Theory states that one learns within the ecology system where one lives and adapts to it. The theory would say the study found that children are adapting to their ecology environment (home, school, and day care life), and the scheduled activities or leisure within these environments are not considered to be part of being over-scheduled.

Limitations

The limitation for the study was the small, non-random sample size. The limited sample of this study was a small day care center in a rural area. If this study had been done in a larger metropolitan area where more scheduling opportunities exist for children, the study would have produced different results.

Implications for Practitioners

The research results show mixed findings of how University of Wisconsin-Stout day care providers are assessing children being over-scheduled. Could it be that the children they are caring for are not being over-scheduled and are having enough quality time with their family and leisure activities? Or, could it be that the staff members may not be educated on the effects of over-scheduled children or even know what it means to be over-scheduled as a child? Children throughout the United States are continually being over-scheduled with activities (sports, church, church programs, etc.), more so with scheduled than leisure activities. This over-scheduling created stress in children.

This research can be helpful to family practitioners by creating a comparison between different segments of the population and by illustrating the impact of over scheduling upon these different segments. If there was another study done in a larger population, it would be possible to compare the results

between the two. The practical use for this study is to allow individuals in the field of family science to be more educated on what over-scheduling of children is and ways to prevent children from becoming over-scheduled.

Implications for Future Research

The next possible step for this form of research is to duplicate this same survey in a larger and more diverse population with day care workers and teachers. Other questions coming out of this research could include being more aware of what creates over-scheduling (home ecological system) or what makes a child over-scheduled.

Conclusion

Our literature informs others that not all children in the United States are being over-scheduled and more education about over-scheduling needs to be administered to family science professionals. This study adds to the body of knowledge that over-scheduling children can create stress for children.

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Hostage

Jessica Bamman
Undergraduate Student, Art and Design

"Art is like medicine – it can heal."
— Damien Hirst

Society has an obligation to acknowledge social injustice in order to motivate action. In my drawings, I subtly portray domestic abuse showing how the action affects the victim's psychological state. Through the process of drawing, I attempt to represent the history, the cycle of repetition, not only as a form of physical abuse, but also as a pattern of emotional abuse. My investigation is based on humanistic empathy and an interest in the potential of art therapy; specifically I am interested in art as a means for communication for those who are not able to speak.

Psychological trauma can potentially become a consistent source of paint throughout life, and always leaves a mark upon the unconscious; I approached my materials and method of working for this series with a parallel kind of history. In my drawings, the memory of marks relates to the longevity of suffering in the individual. Working with the delicate nature of watercolor, every mark that is produced is permanent, resulting in the conflict between damage and beauty. Working with beet juice, pastels, and watercolor I composed an aesthetically pleasing surface that contributes to the tension created by the offensive subject.

Although the work's subject matter is uncomfortable, I approached the process, however, with consideration for presenting imagery that would be universal, and that would connect to a general audience. This allows me to approach the figural representation as structure. I work from photographs in the genre of family portraits. Specifically, the wife taking an image of father and daughter, a traditional display of family pride and joy. Selection of the father and daughter imagery is acknowledgement of the biological fact, that man was created from woman. In my drawings, I use the photograph as a vantage point to reveal the husband's abuse upon the mother through his own children. The mother's passivity, whether conscious or unconscious, takes on the disturbing

role of enabler. The mother's denial or acceptance of abuse, symbolized through taking the photograph, represents the connection between physical and psychological damage produced from the abuse on the mother and that the child witnesses.

My work serves to promote social awareness. My hope is that these drawings reduce the acceptance of the act of violence, increase the probability of intervention, and promote physical and psychological healing to those who suffer.

Jessica Bamman (2005)
"Hostage", Fourth Generation
34" x 47"
Pastel, Watercolor, Beet Juice

Jessica Bamman (2005)
"Hostage", Second Generation
34" x 47"
Pastel, Watercolor, Beet Juice

Jessica Bamman (2005)
"Hostage", Third Generation
34" x 47"
Pastel, Watercolor, Beet Juice

Jessica Bamman (2005)
"Hostage", First Generation
34" x 47"
Pastel, Watercolor, Beet Juice

Variety Series

Valerie Kasinskas
Undergraduate Student, Art and Design

"A skilled crafts person can be described as someone who has mastered the coordination of the motions of his or her hands with the efficient operation of tools. In the practice of the arts, however, we recognize that it is not dexterous manipulative skills alone that produce masterpieces that move our spirit; only by the joint alchemy of mind, imagination, and skill do materials become transmitted into significant works."

—Oppi Untracht

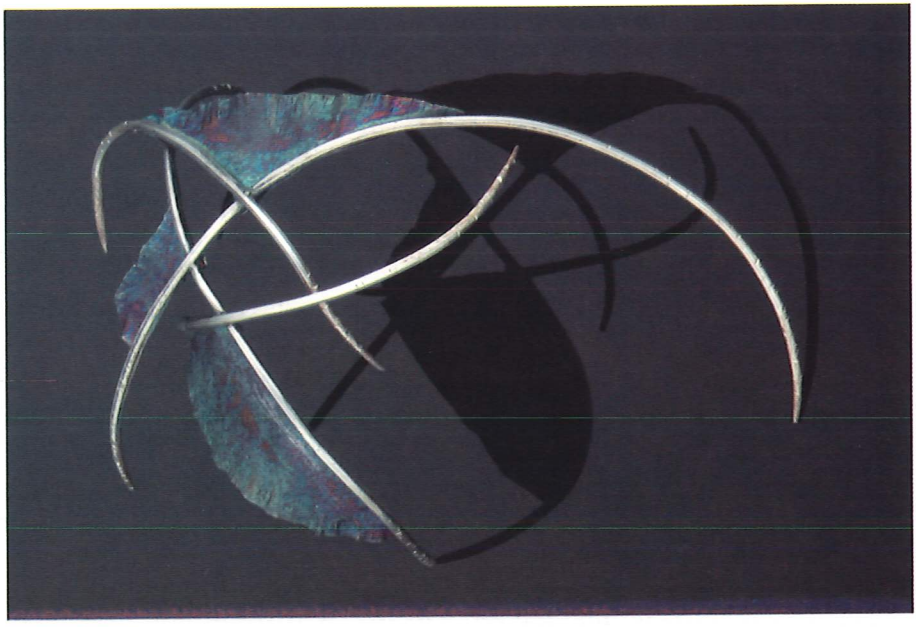
The hand and the mind can work in tandem, but they can be challenged independently of one another. I see the hand being the structure and the mind being variety. Those two words describe my work: structure and variety. The excitement that wells up in me is spurred by them options and possibilities of the mind and hand. I have worked into a semi intuitive method of constructing metal pieces, whether they are sculptures for the body or not. A strong understanding of materials and foundational skills is a must in order to move to another level of working that challenges the brain, then the hand. This is creating a mental space conducive to letting things intuitively happen, yet still maintaining an outlined foundation to function on.

My work is dominated by structure and variety. The structure is constructed metal forms from sterling silver or steel. The variety is other materials utilized that meaningfully enter my life. The structure is sturdy and strong while the material that is suspended within the structure is delicate, organic, and of a different nature than the metal.

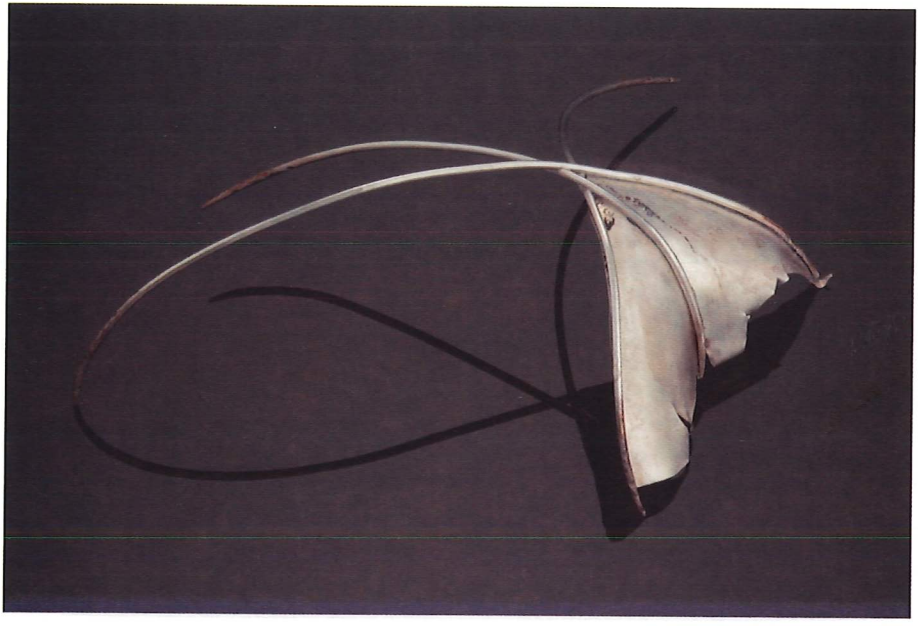
I use the structural component as principle in my work. Here it speaks of physical strength and support; it is durable and wearable. The physical nature also links to larger themes dealing with a different type of reality than physical concepts of organization like reason and society.

The creation of jewelry is as old as human beings themselves. I am inspired by the legacy of the highly creative individuals that have come before, and that are thriving all around us today. I see my placement in

the History of Art and Metalsmithing as similar to the concept that my work is based on: structure and variety. It is grounding and inspiring at the same time.



Valerie Kasinskas (2005)
Variety Serices Brooch



Valerie Kasinkas (2005)
Variety Series Brooch

Valerie Kasinskas (2005)
Variety Serices Bracelet

Valerie Kasinskas (2005)
Variety Serices Bracelet

Blow Out, Flight, Untitled

Emily Walley
Undergraduate Student, Art and Design

My work emphasizes the futile ritualistic acts that are extracted from everyday circumstances. The rituals are based on simplistic actions exaggerated to extremes. Reconfiguring and presenting the act of popping a balloon or tying a string transforms the trite and everyday into an immense challenge.

Through observation and mimicry, I research the many facets of a desired image. I intend to eventually reach a point at which the inherent inanimate quality of the object ceases and a relationship develops. My goal is to provoke a transformation within both the object and myself, displaying the individual's longing to be both creator and destroyer. The transformation I seek is comparable to the universal strive to emulate an image which the individual cannot possibly become or understand. Our failure to achieve inevitably causes further insecurities. I am intrigued by the commonality of failure; the lack of success has the power to bestow both disappointment and possibilities. The absurdities of my performances reflect the same irrational behavior individuals conduct on a regular basis.

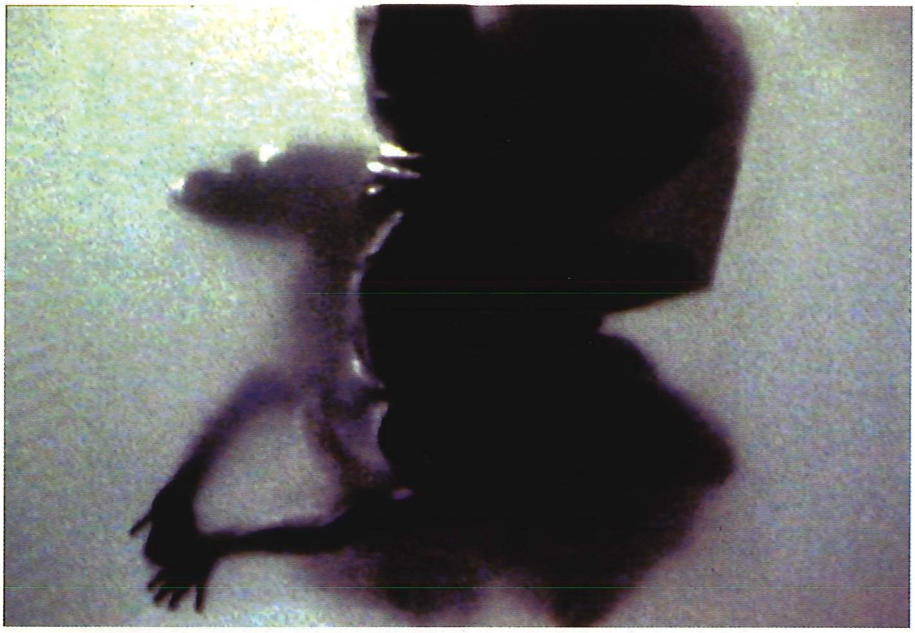
In my work, I find that the battle between the opposing force and myself quickly becomes a clash between three. The mind generates a doubling of my own body or existence; a sense of duality within the self. I prefer to think of my alter ego as a part of me that has already achieved the desired image. A super-heroine, or one with super-human ability, that may defeat both my artificially created opponent and the self.

However, because these fictional characters are fabricated images created by the human mind, they are perhaps as flawed as ourselves. In reality, the skewed persona we desire may be as mentally, physically, sexually and socially inept as each and every one of us.

I often utilize myself in my artwork, because I find that it emphasizes both the narcissistic and submissive qualities of the concept. I intend my work to display the endless humor, absurdity, humiliation and eventually failure of the individual. I allow the viewer to laugh at me, therefore enabling them to find humor in themselves.

Emily Walley (2005)
Blow out

This video involves popping balloons to a soundtrack of birthday music. The piece ends when a relationship forms between a single white helium balloon and the performer.



Emily Walley (2005)
Flight

This video is filmed from below the performer and projected onto the gallery ceiling. This creates the illusion of an opening or skylight in the overhead surface.

Emily Walley (2005)
Untitled

The photographs display separate videos projected opposite one another, on translucent windows of an installation space. The viewer is able to enter between the two projections and become a parrot by mimicking that which already exists.

Analysis of the Transtheoretical Model of Behavior Change

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Keywords: Transtheoretical Model, Behavior change, Stages of change model, Behavior theory, Self change, Health behavior

Abstract

The focus of this paper is on the Transtheoretical Model of Behavior Change (TTM). A description of the model, the applications toward modifying health behavior, and the model's criticisms will all be examined. Through research of published literature, the paper concludes that the model does in fact seem to support health behavior change and shows potential for effective, appropriate intervention. More research is necessary in the area of measurement validity, criteria consistency, and application over unique populations to make the model more widely accepted.

Introduction

The purpose of this paper is to describe the Transtheoretical Model of Behavior Change, discuss the applications it has for modifying health behaviors, and discuss the criticisms of the model. There are many thoughts, ideas, and theories that try to explain how people modify their own behaviors but not one of them is universally agreed upon. The Transtheoretical Model of Behavior Change (TTM), created by Prochaska and DiClemente (1983), is one of the more popular theories used to describe this event.

The TTM is a model of intentional change that focuses on the decision-making abilities of the individual rather than the social and biological influences on behavior as other approaches tried (Velicer, Prochaska, Fava, Norman, & Redding, 1998; Scholl, 2002). This model grew from systematic integration of more than 300 theories of psychotherapy, along with analysis of the leading theories of behavior change (Prochaska & Velicer, 1997). The critical assumptions of the TTM and main constructs which include the stages of change, processes of

change, self-efficacy, and decisional balance will be examined in detail below (Patten, Vollman, & Thurston, 2000; Prochaska & Velicer, 1997; Velicer et al., 1998; Scholl, 2002).

Theory Constructs

Stages of Change

The aspect that makes the TTM unique is the idea that change occurs over time, an aspect generally ignored by other theories of change (Prochaska & Velicer, 1997; Velicer et al., 1998; Scholl, 2002). This temporal dimension of the theory proposes that a person may progress through five stages of change when trying to modify their behaviors (Prochaska & DiClemente, 1983; Prochaska et al., 1992; Prochaska & Velicer, 1997). In the TTM, behavior change is treated as dynamic, rather than an "all or nothing" phenomenon. This distinction is considered one of the theory's strengths (Marshall & Biddle, 2001).

The first stage of the TTM is the precontemplation stage, where people have no intentions of taking action in the foreseeable future, usually measured as the next six months (Prochaska et al., 1992; Prochaska & Velicer, 1997; Scholl, 2002). Individuals in this stage may be unaware or uninformed of the consequences of their behavior (Prochaska et al., 1992; Scholl, 2002) or may have had a number of failed attempts at change and are discouraged to try again (Prochaska & Velicer, 1997). Prochaska et al. (1992) suggest that the main trait of someone in the precontemplation stage is they show resistance to recognizing or modifying a problem behavior. For an individual to move out of this stage they must experience cognitive dissonance, a negative affective state, and acknowledge the problem (Scholl, 2002).

In the next stage, contemplation, individuals are intending on making a change within the next six months (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). People in this stage weigh the pros and cons of making the change which can cause them to remain here for long periods of time (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). A person in this stage is deciding if he or she needs to correct the problem and whether or not the pros and cons of making a change outweigh the pros and cons of maintaining his or her present behavior (Scholl, 2002). Being stuck in this stage is known as chronic contemplation or behavioral procrastination (Prochaska & Velicer, 1997). During this stage the person still participates in the risky behavior but is aware that this behavior causes a problem (Patten et al., 2000). The main trait of

someone in the contemplation stage is that the person is seriously considering resolving the problem (Prochaska et al., 1992). An individual will move on to the next stage if he or she perceives that the pros outweigh the cons and if the force of motivation is stronger for change than it is for remaining stable (Scholl, 2002).

The next stage, preparation, is when the person is planning on making a behavior change within the next month (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). A person in this stage has often unsuccessfully taken some sort of action to change the behavior within the last year, but still engages in the high-risk behavior (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). An individual in this stage may not know how to proceed to make a change and could be nervous about his or her ability to change (Scholl, 2002). A plan of action is made up for elimination or significant reduction of the problem behavior in which the person can choose between alternative potential solutions (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Individuals will move to the next stage when they select a plan of action that they feel will work and if they feel confident that they can follow through with the plan (Scholl, 2002).

In the action stage, individuals have made efforts to modify their behaviors, experiences, or environments within the last six months to overcome their problem (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). The action stage requires a significant commitment of time and energy and is the stage where the individual gets the most recognition from others because of their visible efforts (Patten et al., 2000; Prochaska et al., 1992). Research warns not to mistake this visible action of trying to change with change itself, because the individual's actual change only occurs when a certain criteria has been reached, a criteria which scientists and professionals agree is sufficient to reduce risks the problem behavior (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Prochaska, DiClemente, and Norcross (1992) suggest that the main ways of recognizing that someone is in the action stage is through their significant efforts made to change and through modifying the problem behavior to acceptable criterion levels. Movement into the final stage occurs when an individual sees evidence of performance improvement, has a positive affective state, and receives positive social and performance feedback (Scholl, 2002).

The final stage of the TTM is maintenance (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). In this stage people work to prevent relapse and secure their gains made during action (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Individuals in the maintenance stage are less tempted to relapse and more confident that they will be able to continue their changes (Prochaska & Velicer, 1997; Velicer et al., 1998). According to Prochaska and colleagues (1992) the ability to remain free from the problem behavior and the ability to participate in new incompatible behaviors for more than six months is the criteria used to categorize someone into the maintenance stage. Research also recognizes that maintenance is a continuation of change, not an absence of it (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

The stages of change are often measured using a four- or five-item algorithm in which the questions asked are responded to with "yes" and "no" answers (Prochaska et al., 1994). The responses to the questions reveal whether or not an individual meets the criteria to be in one of the stages of change (Prochaska et al., 1994). The questions asked cover current behavior, future intentions, and sometimes past attempts to change (Littell & Girvin, 2002; Prochaska et al., 1994). Prochaska and Velicer (1997) have found that there is a general rule of thumb when it comes to the distributions of people in each stage. In an assessment of 15 different health behaviors, it was generally found that 40% of the population will be in precontemplation, 40% in contemplation, and 20% in preparation (Prochaska & Velicer, 1997).

Process of Change

The stages of change describe the temporal aspect of when shifts in attitudes, intentions, and behaviors happen. The process of change, which is the second major aspect of the TTM, describes how these shifts occur (Patten et al., 2000; Prochaska et al., 1992; Rodgers, Courneya, & Bayduza, 2001). Ten processes have received the most theoretical and empirical support as the covert (cognitive) and overt (behavioral) activities used to progress through the stages (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Rodgers, Courneya, & Bayduza, 2001; Velicer et al., 1998). The first five processes are used in the early stages and classified as experiential, while the last five are classified as behavior processes and used in later stages, as shown in Table 1 (Patten et al., 2000; Velicer et al., 1998).

Table 1

The Stage of Change Where the Processes of Change Are Most Emphasized

	Stages of Change				
	Precontemplation	Contemplation	Preparation	Action	Maintenance
Processes of Change	Consciousness raising				
	Dramatic relief				
	Environmental reevaluation				
		Self-reevaluation			
			Self-liberation		
				Contingency management	
				Helping relationship	
				Counterconditioning	
				Stimulus control	

Consciousness Raising

Consciousness Raising is a process in which the individual needs to increase his or her awareness about the negative consequences, the causes, and the cures of the problem behavior (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Awareness can be increased through feedback, education, confrontation, interpretation, and media campaigns (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Dramatic Relief

Dramatic Relief is the process in which the individual needs to experience and express his or her feelings and emotions relating to the problem behavior (Patten et al., 2000; Prochaska et al., 1992). Patten and colleagues (2000) suggest that life events such as the death of a family member or close friend can move someone into precontemplation emotionally. This is especially common if the death was related to the problem behavior. Other techniques used to move someone emotionally include psychodrama, role-playing, grieving, personal testimonies, and media campaigns (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Self-Reevaluation

Self-Reevaluation is a cognitive and affective assessment of the individual's own self image with and without the problem behavior (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). This means that people assess the way they feel and think about the problem behavior and may become aware of their guilt towards the behavior (Patten et al., 2000). Patten et al. (2000) suggests that self-reevaluation is most important when the person is moving from the contemplation stage to the preparation stage. Value clarification, healthy role models, corrective emotional experience, and imagery are among the ways to increase chances of self-reevaluation (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Environmental Reevaluation

Environmental Reevaluation is the individual's assessment of how the presence or absence of their problem behavior affects his or her social environment (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Prochaska and Velicer (1997) suggest that environmental reevaluation can include awareness of how the individual functions as a positive or negative role model for others. Strategies to help environmental reevaluation to occur include empathy training, documentaries, and family interventions (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Self-liberation

Self-liberation is the belief within the individual that he or she can change and the commitment to take action towards that belief (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Strategies for self-liberation can include New Year's resolutions, public testimonies, decision-making therapy, logotherapy techniques, commitment enhancing techniques, and multiple rather than single choices (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Research on motivation has shown that people with two choices have greater commitment than those with one choice, and those with three choices have the greatest commitment to ceasing their problem behavior (Prochaska & Velicer, 1997; Velicer et al., 1998).

Social Liberation

Social Liberation is the need for an increase in opportunities or alternatives for non-problem behaviors in society, especially for those who are deprived or oppressed (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Prochaska and

colleagues (1992) report that advocating the rights of the repressed, empowerment, and policy interventions will increase social liberation.

Counterconditioning

Counterconditioning requires the individual to learn to substitute healthy behaviors for problem behaviors (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Relaxation, desensitization, assertion, and positive self-statements all enhance counterconditioning (Prochaska et al., 1992; Velicer et al., 1998).

Stimulus Control

Stimulus Control is the process in which the individual needs to remove any stimuli associated with the problem behavior and replace it with prompts to participate in healthy behaviors (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Restructuring one's own environment, self-help groups, and avoidance can all support appropriate change and reduce risk for relapse (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Contingency Management

Contingency management provides consequences to the individual for participating in problem behavior or for following through and avoiding the problem behavior (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). Punishment can be used with contingency management but using rewards as reinforcement is emphasized (Prochaska & Velicer, 1997; Velicer et al., 1998). Procedures for contingency management include contingency contracts, overt and covert reinforcement, self-reward, and group recognition (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Helping Relationships

Helping relationships involves helping the individual to be open and trusting with those who are actively involved in helping them change their problem behavior (Patten et al., 2000; Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998). This support can be found with self-help groups, therapeutic alliances, buddy systems, counselor calls, and social support (Prochaska et al., 1992; Prochaska & Velicer, 1997; Velicer et al., 1998).

Self-efficacy

The theory of self-efficacy is from the research done by Bandura (1977) which showed that the perception a person has about his or her own abilities to act out a specific behavior is important in determining behavior change. More of Bandura's (1982) research suggests that self-efficacy can help account for changes in coping, levels of physiological stress reactions, achievement strivings, growth of intrinsic interest, and career pursuits. The TTM construct of self-efficacy, integrated from Bandura, is described as the situation-specific confidence that an individual can cope with high-risk situations and not relapse back to the problem behavior (Fallon & Hausenblas, 2004; Patten et al., 2000; Prochaska & Velicer, 1997; Velicer et al., 1998). Self-efficacy is considered important for people to move through the upper stages of change. An example of this would be when an individual moves from the contemplation to preparation stage, and preparation to action stage (Kraft, Sutton, & Reynolds, 1999).

Another aspect of the TTM that is often brought up because of the relationship it has with self-efficacy is temptation (Fallon & Hausenblas, 2004; Patten et al., 2000; Prochaska & Velicer, 1997; Velicer et al., 1998). Temptation is described as the intensity of urges to engage in a specific habit while in a difficult situation (Prochaska & Velicer, 1997). Prochaska and Velicer (1997) go on to acknowledge that the most common types of temptation come from situations of negative affect or emotional distress, positive social situations, and cravings. Studies have shown that temptation and self-efficacy have an inverse relationship with one another across stages of change, which suggests that temptation is highest during the earlier stages of change and lowest during the later stages, while sharing equal levels in the action stage (Fallon & Hausenblas, 2004; Patten et al., 2000).

Decisional Balance

Decisional balance refers to the individual's weighing of the pros with the cons, the benefits of changing the behavior, and the costs of changing the behavior (Patten et al., 2000; Prochaska & Velicer, 1997). The core constructs of Janis and Mann's (1977) decision-making model were used to define decisional balance for the TTM (Prochaska & Velicer, 1997; Prochaska et al., 1994). In a study by Velicer, DiClemente, Prochaska, and Brandenburg (1985) to measure decisional balance for smoking cessation only two factors were used, pros and cons of smoking, rather than eight factors proposed by Janis and Mann (1977) (Prochaska

et al., 1994). The two scales, pros and cons, supported the comparative approach to balancing decisions studied by Janis and Mann (1997) (Prochaska et al., 1994).

The main utility of decisional balance is that it has been identified that individual's judgments of pros and cons vary through the stages of change (Prochaska et al., 1994). During the precontemplation stage, individuals will judge the pros of the problem behavior to outweigh the cons. While in the action and maintenance stages, the opposite will occur, with the cons outweighing the pros (Prochaska et al., 1994). Decisional balance has demonstrated to be a good predictor through the stages of change (Prochaska et al., 1985; 1994).

Critical Assumptions

Prochaska and Velicer (1997) outline the following list of seven assumptions that drive transtheoretical theory, research, and practice: 1) No one single theory can account for all of the complexities of behavior change. 2) Behavior change progresses over time through a sequence of stages. 3) Stages are open and stable to change just as chronic problem behavior factors are both stable and open to change. 4) Without planned interventions, people will remain caught in early stages because there is no inherent motivation to progress through stages of intentional change as there seems to be in stages of physical and psychological development. 5) The majority of at-risk populations are not ready for action and will not be served by traditional action-oriented prevention programs. 6) Specific process and principals of change need to be applied to specific stages for proper progress through the stages. 7) Chronic behavior patterns are often under some combination of biological, social, and self-control. Stage-matched interventions are primarily designed to increase self-controls.

Applications of TTM to Healthy Behaviors

According to Prochaska et al. (1994) the TTM is generalizable across a broad range of problem behaviors as well as a wide variety of populations with such behaviors. These behaviors include smoking cessation (Andersen & Keller, 2002; DiClemente & Prochaska, 1982; Pallonen, Fava, Salonen, & Prochaska, 1992; Prochaska & DiClemente, 1983), quitting cocaine, weight control (Cardinal, 1997; Fallon & Hausenblas, 2004; Marshall & Biddle, 2001; Rodgers et al., 2001), high-fat diets, adolescent delinquent behaviors, safer sex (Patten et al., 2000), condom use, sunscreen use, radon gas exposure, exercise acquisition, mammography screening, and physicians' preventive practices with smokers (Marshall & Biddle, 2001; Patten et al., 2000; Prochaska

et al., 1994). Studies have also examined the TTM over a range of populations including different work-site groups such as medical, industrial, retail, and governmental, as well as age groups, places of residence such as rural and urban, medical conditions, and countries (Rodgers et al., 2001). Many studies have supported the TTM, some of which are examined below.

Patten et al. (2000) tested the TTM with intravenous drug users (IDU's) in hopes of reducing the risk for spreading HIV. The authors observed and interviewed health practitioners, needle exchange program nurses, and harm reduction coalitions who use the TTM framework, and found that it is useful for these providers who work with IDU's in HIV prevention. Patten and colleagues (2000) suggest that by staging each IDU they work with, nurses can gain an understanding of their motivations and use staging to asses which social or environmental processes could be affecting them at the time. An example of how the TTM can be applied in these settings is if an IDU is particularly resistant to drug treatment and has no intention of trying to quit using drugs (the precontemplation stage), nurses would not encourage drug treatment but focus on other behaviors such as HIV prevention (Patten et al., 2000). It is important to note that the TTM doesn't suggest interventions for individuals at each stage but suggests general strategies and approaches to use when counseling clients or patients (Patten et al., 2000).

A study by Rodgers et al. (2001) found support that the principles of the TTM apply to diverse populations. The study examined self-efficacy and processes of change of the TTM with exercise across three populations to determine its suitability for use in diverse groups. The three populations examined were high school students, university undergraduate students, and employed adults. Questionnaires were used to measure the stage of change, process of change, and self-efficacy. The results of the study suggest that the underlying principles of change in the TTM are similar across all populations.

Stages of change and decisional balance (the pros and cons) were examined across 12 problem behaviors in a study by Prochaska and colleagues (1994). Through this study, the researchers found that progress from the precontemplation to contemplation stage involves an increase in the evaluation of the pros of changing the problem behavior while progressing from the contemplation to action stage involves a decrease in the cons of changing the behavior. This finding is significant for programs that use the TTM as the framework for the intervention. The interventions should be advised to target people in the precontemplation stage with efforts towards increasing the pros of changing the problem behavior to create optimum progress. Once this progress occurs, the intervention should aim at decreasing the cons of changing the problem behavior in attempt for progress from the contemplation to action stage. These

results also provide strong support for the generalizability of transtheoretical constructs across a variety of problem behaviors.

Criticisms

Even with an intuitive and heuristic appeal, the TTM does not go without criticism (Marshall & Biddle, 2001). Some critics reject stage-based theories of human behavior on conceptual grounds (Bandura, 1997; Kraft et al., 1999), while others see methodological or analytic flaws and concerns over existing evidence (Macnee & McCabe, 2004; Sutton, 2001). Examples of both these concerns and criticisms are described below.

The TTM has been criticized for the fact that human functioning is too versatile and multidimensional to be categorized into discrete stages (Bandura, 1997). According to Bandura, a genuine stage theory has three defining properties: qualitative transformations across stages, invariant sequence of change, and no reversibility. The TTM violates all of these requirements. Bandura goes on to say that qualitative transformations across stages are violated because the first two stages (precontemplation and contemplation) are only different in their degrees of intention, while the other stages are graduations of regularity or duration of behavioral adoption rather than differences in kind. Invariant sequences of change and nonreversibility does not happen in the TTM because individuals do not all start at the same stage as well as the fact that individuals are able to skip stages within the model. Kraft and colleagues (1999) found no theoretical reasoning or empirical findings to indicate that the six month time frame is appropriate for defining stages. The argument for the six month time frame is that there is an assumption that people plan behavior change about that far into the future (as cited in Velicer et al., 1995). Kraft and colleagues also suggest that the TTM could be reduced to two stages only, precontemplation and one that includes the rest of the stages. This judgment was made due to the clear differences found between precontemplation and the rest of the stages on pros, cons, and confidence. In this instance, the staging algorithm could be reduced to one question: Are you thinking about quitting smoking in the next six months? This suggestion was made because the key difference in definition between precontemplation and the rest of the stages are that precontemplators are not thinking about quitting within the next six months, while contemplators and preparers are.

Macnee & McCabe (2004) do not have conceptual concerns regarding the TTM, but question the applicability of the model to specific populations. The population under investigation is that of Southern Appalachia where cultural characteristics and the history of economic dependence on tobacco raise questions about whether the TTM is appropriate for

smoking cessation. Following TTM framework, the authors found that the distribution of smokers in Appalachian Tennessee was 56% in precontemplation, 30% in contemplation, and only 14% in preparation. This population differs from the national sample in their cognitive and motivational decision making about smoking and smoking cessation. This study raises questions about the applicability of the TTM to unique populations as well as the possible modification of intervention strategies in such areas. Another concern examined by Sutton (2001), suggests that there are some serious problems with the existing methods used to measure the stages of change. Sutton goes on to state that staging algorithms are based on arbitrary time periods, some of which are logically flawed. For example, some questionnaires reveal a pattern of correlations among the subscales that do not measure discrete stages of change, which may contribute the low concordance found between different methods in studies. In the critique by Littell and Girvin (2002), similar evidence has been found. For example, algorithm questions and stage criteria are not consistent across studies that use the approach. Some studies do not include questions about past attempts to change, and various time frames are used as reference points which alter distribution of people across stages (as cited in Lerner, 1990; Nigg et al., 1999; Stevens & Estrada, 1996; Weinstein et al., 1998). Finally, Littell and Girvin (2002) suggest that a continuous model of readiness for change may be more integrated with related concepts from other theories. They also recognize that there is importance in distinguishing readiness for change from readiness to participate in particular treatments, and that change can come about quickly as a result of life events or external pressures.

Conclusion

The purpose of this paper, to describe the TTM, discuss the applications it has for modifying health behavior, and discussion of the criticisms of the model have seemingly led to a stalemate. At the present time there are stacks of evidence supporting the model, verifying the constructs, and showing support for application to modifying health behavior. Also, at this time there is an increase in the number of studies criticizing the model over conceptual, methodological, and analytic concerns. Possibly because the TTM is a fairly new construct it has not had the chance to be studied and criticized as older theories have. It will be interesting to see what future research will find when examining the Transtheoretical Model of Behavior Change.

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Do Men Deserve More Credit? A Study on Gender and Caregiving

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Key Words: willingness, care, gender, college attitudes, financial support, personal hygiene, housework, socialization

Abstract

Care for the elderly population in the United States is fast becoming an issue many families are facing. This study investigated the relationship between gender and willingness of college students to care for aging parents by surveying 24 male and female undergraduate and graduate students at the University of Wisconsin-Stout. It was hypothesized that female college students would be more willing than men to care for aging parents in the assistance categories of personal hygiene and housework. Survey data was statistically analyzed using cross-tabulations, and mean comparisons. Results indicated that males are more willing to provide care in the categories of personal hygiene and housework. These findings did not support the hypothesis of females being more willing to provide care; the implications are that the traditional roles and stereotypes need to be reassessed.

Introduction

With the increasing numbers of the elderly, it has become an issue as to who will care for all of these aging people. There have been numerous studies dating back to the 1960s that have reported and researched that it is family members who care for the majority of assistance related to medical and personal care for the elderly (Datwyler & Montgomery, 1990). Although it is clearly noted that women outnumber men in all caregiver categories which include financial support, personal hygiene care, and help with the housework, there is a concern regarding the amount of willingness or support of care that comes from males and females (Stone, Cafferata, & Sangl, 1987). Willingness is defined as "an act or voluntarily ready to act gladly" (Agnes, 2000, p. 1683). Care can be

defined as giving assistance in any of the following categories: financial support such as living arrangements, medical payments, and everyday living expenses; personal hygiene care which includes bathing, giving medication, and facilitating therapy/exercise sessions; and housework including cleaning, laundry, and meal preparation (Eriksen & Gerstel, 2002). Our hypothesis is that female college students will be more willing to care for aging parents in the majority of the assistance categories which consist of personal hygiene and housework.

Literature Review

The increasing numbers of elders has raised concern about caring for the elderly, so it isn't surprising that caregiving has become a hot topic both in families and the greater society. Many recent studies have examined the role of age and gender in caregiving. It is imperative to understand important concepts that are relevant to studies done regarding gender and caregiving.

Socialization is an important concept in understanding the differences between genders. When examining males and females, it is crucial to understand the socialization process that occurs in the family and society, and how that shapes gender roles. Caregiving in this study refers to an adult child taking on responsibilities of helping a parent with daily living activities. Caregiving can include but is not limited to: cooking, personal hygiene care, household work, emotional support, and financial support (Eriksen & Gerstel, 2002).

In a study comparing adult sons and daughters, Ada C. Mui (1995) found that there are specific gender differences in the approach to caregiving. Consistent with prior research, she found women make up the majority of caregivers. The article also discussed the division of labor differences between sons and daughters when it comes to caregiving for their parents. Mui's research found that females are more likely to experience higher levels of emotional strain and provide more domestic and personal care while men provide more home repair and financial assistance. Mui believed these differences occur because men and women are socialized differently. Women are socialized to feel an obligation toward parents. Also, women put an emphasis on the relationships with family members and place a high level of importance on the quality of the interaction, which could be the reason they experience more emotional stress than male caregivers.

According to research done on intergenerational differences where children felt obligation to care for aging parents, there are differences

between young adults and their middle-aged parents (Freeberg, et al. 1998). The study included a sample of college students and their parents. The purpose was to see who felt a higher level of obligation toward their parents, the younger group or the middle aged individuals. The results were that young adults felt a higher level of obligation. An analysis concluded that the students from the study were likely to still be dependent on their parents, which could account for the findings. Also, the study's results found that in both groups women reported higher levels of felt obligation than men.

According to Eriksen and Gerstel (2002), gender is a central basis of care giving. In this particular study it suggested that women give more care than men do and that women give different kinds of care. The kinds of care women are more likely to give are: practical care (i.e. doing the laundry, meal preparation, child care, and cleaning), personal help (i.e. talking about problems and advice giving), and maternal help (i.e. money and gifts). The study also revealed that if a sister is in the family, she is more likely to support the care giving duties between the family members. Although the study did prove that it is not just gender that care giving is based around. Age is also a consideration (Eriksen & Gerstel, 2002).

Gallagher and Gerstel's (2001) research on gender and care suggested that women who are caregivers are more willing to give care because they are internalized to give nurturance through their early socialization. Many times, men are characterized to separate themselves with individuality, competition, and detachment from early socialization. This article stated that men who are married and have children, especially who have girls, are more likely to be more supportive of feminine roles. This study concurred with Eriksen and Gerstel (2002) by verifying women are more likely to do the "feminine jobs" such as cooking and providing child care, but men and women are both likely to support their parents with neutral projects such as money and advice.

From reading the research, it is evident that women are more likely to provide the role of caregiver. There are other factors that also relate to whether or not an individual will be a caregiver including, age, family background and felt obligation. Although there has been extensive research on who is providing current care, less is known about potential caregivers. By looking at the willingness of an individual to care for an aging parent, we bridged a gap in the research. Although one study looked at the obligation individuals feel toward become a caregiver for their parent(s), we wanted to understand and compare the willingness of a demographic that hasn't been studied much—college students.

In order to bridge the gap in previous research, our study focused on the willingness of college students to be caregivers to their adult parents. Our research aimed to answer the question "Is there a relationship between gender and the willingness of college students to care for aging parents?"

Theoretical Framework

The theory that we used in this study is Feminist Theory (Ingoldsby, Miller, & Smith, 2003). Feminism was a movement started by women in the mid 1800s. After the first wave of Feminism came the modern feminist movement, which began in the 1960s. Issues of this movement were for equal pay on the job, maternity leave, abortion and birth control, and child care. Today, Feminists continue to fight for equal rights of oppressed groups. Feminist theory indicates that gender is socially constructed, that history and society play key roles in understanding women and families, and that Feminism focuses on social change. As applied to our study, this theory would predict that female college students would be more willing to care for aging parents than male college students because women are socialized to be caregivers. Starting out from birth, male and females are treated and viewed differently according to their gender. Females are socialized by their parents and society to believe that caring for others is "women's work" (Ingoldsby, Miller, & Smith, 2003). Feminist theory helped us decipher why there are gender differences in our research findings.

Methods

Participants

The site of this study was at the University of Wisconsin-Stout in Menomonie, WI. The participants in the study were 12 female and 12 male students currently enrolled at Stout.

Research design

We used the cross-sectional design because it allowed one-time contact with the participants and was economical and easy to analyze. We chose to collect our data at the UW-Stout Johnson Fieldhouse because it is used by students attending the university. Due to the small sample size and lack of randomization, the results will not be able to be generalized to the larger population. Participants were given self-administered questionnaires, which allowed us to ensure anonymity. By using the questionnaires we were guaranteed a high rate of returned sur-

veys. Quota sampling was the best fit because it allowed us to identify visible characteristics of gender. This design also allowed us to pick a convenient location on campus. In order to protect all participants' rights, we completed the online Human Subjects Training through the University of Wisconsin-Stout.

Instrument

We designed the survey to study the willingness of college students to care for aging parents. The questionnaire included a cover letter that explained to participants the purpose of the study and also ensured them that their responses would be held in confidence. It explained that all participation was voluntary. The questions included on the survey were generated from literature in the field about this topic; specifically, we modeled the questions after categories created by Eriksen & Gerstel (2002). We started with the general question asking if participants would be willing to care for their parents, and then broke it down into specific type of support they would be willing to give, including, financial support, personal hygiene care, housework, and if they would be willing to take on sole responsibility for a parent. We used the Likert scale to measure the participants' answers. This allowed participants to answer the questions by a scale of 1 to 5, with varying degrees of agreement, 1 being strongly disagree, and 5 equaling strongly agree. In order to ensure the validity of the survey we piloted it on two students before giving it out to our participants. After piloting, we found no changes were needed to be made in order to clarify any of the concepts.

Procedure

The procedure involved distributing the surveys at the Johnson Fieldhouse at UW-Stout on Wednesday March 23, 2005. The surveys were handed out to students entering the multi-purpose room. Students who were identified according to their gender were asked to complete the survey. The surveys were handed out until we had 30 surveys completed: 12 male and 12 female. We chose not to attempt to randomize, since our only variable was gender. The surveys included a cover letter that explained to participants who we were and the purpose of our study. The instructions asked participants to answer the statements by circling the best answer that reflects their attitudes. The participants completed the questionnaire in our presence and returned it to us upon completion.

Data analysis plan

We cleaned the data by checking questionnaires for completeness and removing all incomplete questionnaires. We created a codebook by assigning numerical values to answers we obtained from our participants. We assigned variable names to each of our questions and a numerical value for each response.

Our variables included gender (GEN), willingness to care for an aging parent in general (WIL), financially (FIN), with personal hygiene care (PER), housework duties (HW), and take on sole responsibility for a parents care (SOLE). We conducted frequencies on each variable to detect missing data. To do this we used the SPSS statistical computer package to analyze the data. Our level of analysis is on the individual.

Results

We hypothesized that females would score higher in HW (housework) and PER (personal hygiene). After conducting our analysis, our statistical findings demonstrated mixed support for our original hypothesis.

The Statistical Package for Social Sciences (SPSS) program was used to analyze our data. The statistical analysis performed on each variable included: means comparison and cross-tabulations. Cross-tabulations were conducted on variables. The independent variable in our study was gender; the dependent variables were WILL, FIN, PER, HW, and SOLE.

The results for (WILL) supported our hypothesis; in that 75% of males agreed or strongly agreed that they would be willing to provide care to aging parents, whereas 83.4% of females responded the same.

The responses for (HW) indicated that all male respondents either strongly agreed or agreed, whereas 8.3% of females disagreed that they would be willing to provide housework support for their aging parents. This does not support our hypothesis, as females were less willing to provide housework support.

The responses to the financial question (FIN) did not support our hypothesis, because females were more likely than males to be willing to provide financial care for aging parents. Overall, 58.4% of males agreed or strongly agreed, while 83.4% of females responded positively.

Answers for (PER) did not support our hypothesis either. Male respondents had a combined 66.7% for agreement categories in personal hygiene care, while females total for the two was 41.6%. Females also disagreed at 25% compared to 8.3% of males.

The responses for (SOLE) indicated that although more males agreed to take sole responsibility for care (33.3%), compared to 25% of

females, they also were the only ones to responded "strongly disagree" to the question. Therefore, this neither supported nor countered our hypothesis.

Means comparisons were conducted on WILL, FIN, PER, HW, and SOLE (Refer to Table 1). Mean comparison results indicate that means for variables were higher for males in PER and HW, indicating our hypothesis was incorrect. For WILL, FIN and SOLE, means for variables were higher for females, which supported our general hypothesis, which stated that females are more likely to care for aging parents.

A reliability analysis was conducted to indicate if our five variables, WILL, FIN, PER, HW and SOLE, were a reliable index to measure attitudes college students have on caring for aging parents. Cronbach's Alpha is a measure of reliability, and in our analysis was .7748. This value indicates that our survey items were a reliable index of our major concept of attitudes college students have about caring for aging parents.

Discussion

Our findings that more females would be willing to care for aging parents supported our original hypothesis. The idea that female college students would be more willing to care in the categories or PER and HW was not supported by our results.

The literature we reviewed found that women compose the majority of caregivers and provide more domestic and personal care (Mui, 1995). A reason behind this is the socialization of women to be nurturers (Eriksen & Gerstel, 2002). Our results provided mixed support for the literature. We found that females were more likely in the category of WILL, but that more males would be willing to provide care in the categories of PER and HW, which we considered domestic and personal care like Mui.

One possible explanation as to why this occurred could be that females and males are socialized differently than in past generations. Traditional gender roles could be more flexible now, which would help explain our findings. Males could be becoming socialized to be nurturing, therefore more willing to be caregivers. Another explanation for why so many males stated they would provide personal hygiene care could be because the terms in our survey did not provide examples defining personal hygiene care, which may have provided different results if defined.

Our findings have implications for family practitioners. Practitioners should be sensitive to the issue of gender in caregiving. Previous stereo-

types that put women in nurturing roles, and not men, need to be challenged. Men need to be identified and supported in their caregiving roles. Because the findings support the idea of males in caregiving roles, more research and data should be collected in order to study if there really is a social change occurring.

Limitations

The limitations in our study include a small, non-random sample size. Because of the small sample size we were not able to generalize to the larger population. Although race was not assessed in our survey, the majority of our participants were of Caucasian background. The results might have differed with a sample of non-educated individuals in that more traditional gender roles would have been reflected in the answers.

Implications for Future Research

One conclusion is the possibility that males might have not understood the full extent of care within the personal hygiene category. For future research we recommend that personal hygiene be defined for participants. Personal hygiene care could be defined as bathing, medicating, and bathroom assistance.

Studies on socialization may contribute to furthering knowledge on this topic. If more males are responding with answers that reflect care and nurturance, it could be that males are being socialized differently than in the past.

Conclusion

This study challenged previous assumptions we had regarding gender in relationship to caregiving. Although our results did not support our hypothesis, we are excited about the results because they could be reflecting changes occurring in the socialization of males and females. We are hoping that as a result of our research, individuals will challenge their stereotypes about males and females.

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Table 1

Means

	WILL	FIN	HW	PER	SOLE
Male:					
Mean:	4.083	3.5	4.83	3.67	2.58
SD:	.996	1.62	.389	1.23	1.56
Range:	3.0	4.0	1.0	4.0	4.0
Female:					
Mean:	4.17	3.83	4.25	3.08	3.0
SD:	.937	1.03	.866	1.16	1.04
Range:	3.0	4.0	3.0	4.0	3.0

Note. (GEN)=Gender; (WIL)= Willingness to care for an aging parent in general; (FIN)= Financially; (PER)= Personal hygiene care; (HW)= Housework duties; (SOLE)= Take on sole responsibility for a parents care.

Investigation of Chemical and Physical Properties of Southwestern Wisconsin Maple Syrup

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Keywords: Maple Syrup, Chemical Properties, Physical Properties, Grading System, Seasonal Effects, Filtration

Abstract

Maple syrup is produced in the early spring from February through April when maple sap runs from the maple trees. It is traditionally known that the maple syrup produced from the sap in the later season tends to have a darker color. Interestingly, although the maple syrup grading system in the United States gives lower grades and values for darker maple syrup, some consumers prefer dark syrup to light syrup. Therefore, the seasonal variation of important maple syrup parameters was investigated. The other aspect of this study was to determine whether the filtration process in maple syrup production removes some nutritional value from the product. In this research, filtered and unfiltered samples, prepared weekly during the five-week season, were compared with respect to their physical and chemical properties. It was found that the concentrations of calcium, iron, fructose and glucose tended to be higher, while sucrose tended to be lower as the season progressed. The filtration process did not seem to be a significant factor in influencing the concentrations of minerals and sugars.

Introduction

Maple syrup is one of the most common sweeteners in the United States. The maple syrup industry is quite dominant in Canada and eastern North America including Wisconsin. Maple syrup is produced from maple sap, a slightly sweet, transparent liquid, tapped from maple trees. Maple sap is boiled down to 1/35 to 1/40 in volume when it becomes syrup. Maple syrup is then pasteurized, filtered, graded, and packaged before it is marketed. Compared to table sugar, which consists of only sucrose, maple syrup contains a variety of nutrients such as

minerals, organic acids, amino acids, and vitamins as well as sucrose and other sugars such as glucose and fructose.

The United States' legal definition of maple syrup states that maple syrup contains "not more than 35 percent of water, and weighs not less than 11 pounds to the gallons (231 cubic inches)" (Willits & Hills, 1976, p. 93). This definition allows the industry to standardize the properties of maple syrup in order to ensure a certain quality. In fact, a grading system is used to guarantee maple syrup quality. The grade of maple syrup is determined mainly by the color of the product measured by means of accepted grading kits such as the United States Department of Agriculture (USDA) permanent glass color standards. Maple syrup is graded based upon its color. Lighter maple syrup receives higher grades, while darker syrup receives lower grades. The standards give three grade levels: United States Grade A, United States Grade B, and Substandard. United States Grade A is the highest grade in the United States (with the exception of the state of Vermont, where "Fancy" grade is the highest) and it is the lightest color among the three grades. United States Grade A is subdivided into three more grades, United States Grade A Light Amber, United States Grade A Medium Amber, and United States Grade A Dark Amber according to the color of product. United States Grade B is darker than United States Grade A Dark Amber, and considered unsuitable for consumer labeling. The standards also describe the higher grade maple syrup as having better flavor, clearer color and fewer defects.

The color of the maple syrup is mainly a result of the time of season the maple sap is collected from maple trees. It is generally known that the later in the season the sap is collected, the darker the color of the resulting maple syrup. Driscoll (1998) described in her article how the dark color of maple syrup is a function of the size of sugar molecules in maple sap. As the season progresses, the temperature warms and wild yeasts begin to break down the sugar molecules into smaller components which absorb more light than larger molecules. In fact, microorganisms convert sucrose that is in maple sap to glucose and fructose (invert sugar) by enzymatic hydrolysis (King & Morselli, 1983; Morselli & Whalen, 1991).

Driscoll (1998) determined from blind taste tests of maple syrups that consumers tended to prefer dark maple syrup since they wanted syrup that tasted like the "real thing." This result is quite interesting since the maple syrup preference given by consumers does not agree with the level of grade, where the lighter maple syrup is given a higher grade.

Though the color of maple syrup is dark, there is a possibility that its nutritional value is equal to or better than lighter syrup. The other aspect of this study was to investigate if the filtration process in the maple syrup production removes some nutritional values from the maple syrup products. In this research, five different seasonal filtered maple syrup samples and their unfiltered samples were investigated concerning their physical properties (density, absorption spectrum, solid content, and water activity) and their chemical properties (pH, mineral contents and sugar contents).

Methodology

Materials

Ocooch Mountain Acres, LLC, Westby, Wisconsin supplied ten glass bottles of maple syrup, including five unfiltered and five filtered samples. Maple sap used for these samples was collected five times from March 17 through April 4 in 2004 from Westby, Wisconsin, and separately processed by the syrup maker. Since the first four samples were made from the sap collected for a four-day period, and the last sample was made from the sap collected for a three-day period, the samples are designated as follows: 4D-N, 8D-N, 12D-N, 16D-N, and 19D-N for unfiltered samples, and 4D-F, 8D-F, 12D-F, 16D-F, and 19D-F for filtered samples. The earliest seasonal samples, 4D-N and 4D-F, had the lightest color, while the latest seasonal samples, 19D-N and 19D-F, had the darkest color. Filtered samples were produced by going through all processes including boiling, pasteurization, filtration, and packaging. Unfiltered samples were collected in glass bottles right after the boiling process, but no pasteurization or filtration were applied.

Density and pH Analysis

Prior to the measurement of density and pH, each maple syrup sample was kept in a Fisher Isotemp Water Bath (FisherScientific) at 25 degrees Celsius. Density was determined by measuring the weight of the maple syrup sample and the specific volume (1.00 mL). To measure the exact 1.00 mL of sample, a Repeater 4780 (Eppendorf) was used with the 12.5 mL combitip. The weight of the sample was recorded to four decimal places by using an analytical balance (AG balance-AG 135, Mettler-Toledo GmbH). Three measurements were done per sample (triplicate), and the average for each sample was calculated. The pH for each sample was measured once and determined using a model 6050 (Sargent-Welch Scientific Company) pH meter with a glass combination

electrode. Calibration of the meter was accomplished with pH 7.0 and 4.0 buffers.

Visible and UV Light Absorption Spectrum

Prior to the measurement of absorbance, maple syrup samples were diluted appropriately with Milli-Q water (Millipore) according to the color of the products. Samples 4D-N, 8D-N, 12D-N and 4D-F, 8D-F, 12D-F were diluted by the factor of 50, and samples 16D-N, 19D-N and 16D-F, 19D-F were diluted by the factor of 100. Absorbance of each sample was measured by using a Hewlett Packard 8452A Diode Array UV-Vis spectrophotometer with the wavelength range from 250 nm to 750 nm. Due to the measurements in UV range, a 1-cm quartz cell was chosen in this experiment. As a reference, Milli-Q water was used. The relationship between absorbance and wavelength was plotted in the computer as graphics, and the possible compounds were estimated according to the wavelength at which the maximum absorbance was observed.

Solid Content

About 1g of each maple syrup sample was put in a 30-mL beaker by using a Repeater 4780. The weight of the empty beaker and the sample taken in the beaker were separately measured by using an analytical balance. The sample was dried by using a Fisher Isotemp® Model 282A Vacuum Oven (Fisher Scientific) until all water was dried out. The temperature of the vacuum oven was set at 75 degrees Celsius, and the pressure was set at 5.0 to 8.0 in Hg. The total weight of the beaker including the sample was measured, and then solid content was calculated with the following equation. Duplicate measurements were done per sample.

Solid content (%) = Wa/Wb x 100

Where:

Wa (g) = weight of a sample after dried

Wb (g) = weight of a sample before dried

Water Activity

Water activities of maple syrup samples were measured by using an AquaLab Series 3 Model TE (Decagon Devices, Inc.). The instrument was kept with a set temperature at 25 degrees Celsius prior to measurements. The small portion of maple syrup sample, temperature equilibrated with room temperature, was poured in a plastic sample dish until the

bottom of the dish was covered by the sample, and then the dish was loaded in the instrument. Water activity was automatically measured in approximately 5 minutes. The measurement was done once per each sample.

Mineral Analysis

In order to carry out the quantitative analysis, standard solutions of three elements (potassium, calcium, and iron) were prepared. For the potassium and calcium standard solutions, 0.5, 1.0, 2.0, and 4.0 mg/L solutions were prepared, and for the iron standard solution, 0.1, 0.3, 0.5, and 0.8 mg/L solutions were prepared. For the K and Ca analysis, maple syrup samples were diluted by the factor of 1000, and for Fe analysis, the samples were diluted by the factor of 100. Mineral contents were measured by using a Thermo Elemental SOLAAR S4 atomic absorption spectrophotometer with appropriate hollow cathode lamps as light sources. The wavelengths for the measurements of minerals were set at 766.5 nm for K, 422.7 nm for Ca, and 248.3 nm for Fe. Air-acetylene was used as oxidant-fuel combinations. Standard solutions and diluted maple syrup samples were measured three times per each (triplicate). By using standard curves, mineral contents in the maple syrup samples were determined.

Sugar Analysis

Five different concentrations: 0.1, 0.25, 0.5, 1.0, and 2.0% were used for the standard solutions of glucose, fructose, and sucrose. For the glucose and fructose, the maple syrup samples were diluted by the factor of 20, and for the sucrose, the samples were diluted by the factor of 40. All standard solutions and diluted maple syrup samples were passed through a 0.45 Ìm syringe filter (Arbor Technologies, Inc.) in order to remove particulates prior to HPLC analysis. Samples were analyzed on a Waters HPLC (system) equipped with a manual UGK injector, and a Waters R401 differential refractometer detector using a SupelcosilTM LC-NH2 column (250 mm x 4.6 mm, 5 Ìm) (Supelco). Chromatograms were plotted employing Dynamax MacIntegrator II software (Rainin Instrument Co., Inc). As mobile phase, the solution of 85% acetonitrile and 15% Milli-Q water was filtered and degassed in a vacuum filtration system. Flow rate and injection volume were set at 2.0 mL/min and 20 Ìm, respectively. From the chromatograms, standard curves were constructed according to the peak areas and sugar concentrations of the standard solutions.

Result and Discussion

According to the pH measurements (Table 1), all samples were slightly acidic. This indicates that maple syrup is not a pure solution of sugars, but a complex compound containing minerals and organic acids. The unfiltered maple syrup samples showed slightly lower pH than the filtered maple syrup samples. The removal of the sugar sand, which consists of calcium and magnesium salts and malic acid, may have affected the pH and increased it in filtered samples compared to unfiltered samples. Sample 16D-N, 4D-F, and 16D-F showed a slightly higher pH and density than the other samples. This is probably because the compositions of maple syrup, such as minerals and organic acids, and their amounts will change according to the season when the maple sap was taken. By comparing the data obtained by Stuckel and Low (1996), the pH of maple syrup produced in Wisconsin ranged from 6.20 to 7.90. The mean of the pH of filtered sample obtained from this experiment was in this range. Though one of the unfiltered samples was slightly lower than the range, it was still higher than the lowest pH (pH = 5.64) found in the maple syrup produced in Quebec in Canada (Stuckel & Low, 1996).

The mean of moisture content calculated by subtracting the mean of solid content (Table 1) from 100 for unfiltered and filtered samples was 32.08% and 32.37%, respectively. According to the data obtained by Stuckel and Low (1996), the moisture content of maple syrup produced in Wisconsin ranged from 28.1% to 33.0%. From this data, the moisture content and the solid content of the ten maple syrup samples used in this experiment are well within the range observed for Wisconsin maple syrup. Sample 16D-N, 4D-F, and 16D-F gave slightly higher solid content than other samples, which exactly corresponded to the result of density.

From the result of solid content and water activity (Table 1), it was observed that the higher the moisture content the maple syrup sample is, the higher the water activity. In general, the food which has higher moisture content tends to have higher water activity though some exceptions are found (Fennema, 1996). Regarding the microbial spoilage of food product, it is reported that most spoilage bacteria do not grow below aw = 0.91 and most spoilage molds and yeasts do not grow below aw = 0.80 and 0.88, respectively. According to the data obtained, all water activities were below 0.86, which indicates that pathogenic bacteria are not likely to grow in the maple syrup. Although most spoilage molds and yeasts are hardly seen in the condition, there is still possibility that some types of molds and yeasts could be found in syrup if once contaminated.

According to the measurements of maximum absorbance (Table 1), all maximum absorbance were observed in the same wavelength in ultraviolet region (271 nm to 275 nm). This result indicates that the maximum absorbance was obtained by the same or similar type of compounds existed in the maple syrup. One possibility for the source of these compounds is a series of phenolic compounds such as benzoic acid derivatives, cinnaic acid derivatives, and coniferyl alcohol. Kermasha, Goetghebeur, and Dumont (1995) detected these phenolic compounds with the wavelength at 280 nm. It was also found that the later the season when the maple sap was taken, in other words, the darker the color of maple syrup is, the greater the maximum absorbance is. From the above discussion, the darkening of the color of the maple syrup may be caused by the certain group of compounds found in higher concentration in the later season.

Table 1

pH, Density, Solid Content, Water Activity, and Maximum Absorbance of Unfiltered and Filtered Maple Syrup Samples

Sample Number	pH	Density (g/mL)	Solid content (%)	Water activity	Maximum Absorbance (AU)
4D-N	6.28	1.320[a] ± 0.003[b]	67.3	0.842	0.25333
8D-N	5.96	1.322 ± 0.003	67.7	0.844	0.36195
12D-N	5.87	1.324 ± 0.002	67.1	0.843	0.75463
16D-N	6.46	1.329 ± 0.008	69.2	0.841	0.82042
19D-N	6.32	1.323 ± 0.003	68.3	0.847	1.9668
4D-F	6.64	1.333 ± 0.004	68.8	0.854	0.24387
8D-F	6.53	1.322 ± 0.002	67.2	0.851	0.32938
12D-F	6.36	1.325 ± 0.002	67.1	0.848	0.71874
16D-F	6.60	1.333 ± 0.006	69.1	0.854	0.82836
19D-F	6.33	1.318 ± 0.002	65.9	0.855	1.81418

Note. [a]Mean; [b]standard deviation

From the result of mineral analysis (Table 2), the K+ concentration remained static through the whole season. The Ca2+ concentration, on the other hand, showed clear elevation as the season progressed. The Fe2+ concentration did not show any clear tendency in the change of concentration through the season although a slight tendency of elevation was observed. The data of mineral content in maple syrup obtained in this experiment was compared to the data in the literature (Stuckel & Low, 1996; Robinson, Mac Lean, & Mac Connell, 1989). Although the average concentration of each mineral obtained in this experiment was relatively higher than the average values in the literature, most of the concentrations of Ca2+ and Fe2+ were still found in the higher range of concentrations in the literature. Any individual concentration of K+ slightly exceeded the maximum value found in the literature, however, they were similar. By comparing the unfiltered samples to the filtered samples, the concentration of K+ and Ca2+ in unfiltered samples was more or less lower than those in filtered samples. The concentration of Fe2+ in unfiltered samples was, however, slightly higher than those in filtered samples. There is a possibility that some additional minerals could be introduced into maple syrup from the pasteurization, filtration, or packaging process although some type of minerals would be removed with sugar sand by filtration process.

The concentration of fructose, glucose, and sucrose is shown in Table 2. In terms of the seasonal effect, there was a slight tendency for the concentration of fructose and glucose to increase as the season progressed, while concentration of sucrose decreased. This change was especially significant in the latest seasonal samples (19D-N and 19D-F). This tendency corresponds to the fact that when the season progresses and the weather becomes warm, bacterial activity proceeds the decomposition of sucrose in the maple sap in maple trees, and the sucrose is converted into the invert sugars (glucose and fructose) (Driscoll, 1998). Driscoll (1998) also noted that more concentration of invert sugars in maple sap would result in a darker maple syrup product.

There was no important difference observed between filtered and unfiltered samples in each sugar concentration. According to the data obtained by Stuckel and Low (1996), the concentration of fructose, glucose, and sucrose in maple syrup samples produced in Wisconsin was $0.22 \pm 0.51\%$, $0.27 \pm 0.22\%$, and $69.9 \pm 1.2\%$, respectively. By comparing the data obtained from this experiment to the literature data, fructose and glucose concentration was slightly higher but sucrose concentration was slightly lower than the literature data of the Wisconsin maple syrup.

This data indicates the possibility that the more inversion of sucrose may have occurred in the trees before sap was taken.

Table 2

Concentrations of Minerals (Potassium, Calcium,and Iron) and Sugars (Fructose, Glucose, and Sucrose) in Unfiltered and Filtered Maple Syrup Samples

Sample Number	Mineral concentration (mg/L)			Sugar concentration (%)		
	Potassium	Calcium	Iron	Fructose	Glucose	Sucrose
4D-N	2968[a] ± 209[b]	1104 ± 16	11 ± 2	0.31	1.24	65.94
8D-N	2693 ± 154	1310 ± 13	11 ± 0	0.32	1.49	61.98
12D-N	3087 ± 122	1588 ± 4	13 ± 1	0.55	1.99	68.81
16D-N	3375 ± 122	1715 ± 10	9 ± 1	0.44	2.14	68.43
19D-N	3111 ± 122	2278 ± 16	20 ±1	1.47	3.33	61.00
4D-F	3568 ± 22	1211 ± 11	10 ± 2	0.42	1.49	70.29
8D-F	3141 ± 17	1177 ± 25	9 ± 1	0.42	1.48	62.26
12D-F	3501 ± 15	1642 ± 20	11 ± 2	0.87	2.27	64.78
16D-F	3802 ± 2	1787 ± 25	19 ± 2	0.38	1.97	69.27
19D-F	3620 ± 27	2565 ± 34	16 ± 2	1.20	3.21	61.77

Note. [a] Mean, [b] standard deviation

Summary and Conclusion

The values of pH, solid content, mineral contents, and sugar contents of maple syrup samples obtained in this research were compared to the literature values. All of the values were reasonable and found in the literature except K+ concentration, which was quite close to the range. All values of pH and solid content were in the range found in maple syrup produced in Wisconsin, except one pH value, which was still found in the range of Quebec maple syrup.

Seasonal effects

The result of visible and UV light absorption spectrum showed that the later the season the maple syrup sample was produced, the greater

the maximum absorbance observed at a wavelength of 271nm to 275 nm. Although specific chemical compounds were not identified in this research, according to the literature, phenolic compounds were some of the possible compounds which are known as the influential factors of the color and flavor of maple syrup. The result of the mineral analysis showed that calcium concentration in maple syrup increased as the season progressed, and a slight increase in iron concentration was also observed. This result indicates that the warmer weather affects the metabolisms of maple trees, and more calcium and iron exist in the sap later in the season. The result of the sugar analysis showed that fructose and glucose concentrations increased and sucrose concentration tended to decrease as the season progressed. This result corresponded to the fact that the amount of invert sugars affects the darkening of maple syrup. The pH, density, solid content, and water activity did not show any clear tendency in terms of seasonal effect, although 16D-N, 4D-F, and 16D-F showed higher pH, density, and solid content than the other samples.

Filtration effects

It was expected that the concentrations of minerals and sugars in filtered samples were lower than the concentrations in unfiltered samples due to the removal of those components by filtration; however, the numbers of the measurements of filtered samples which showed lower concentration of minerals and sugars than unfiltered samples were only 10 out of 30 measurements (33.3%). This data indicates that the filtration process used for producing the maple syrup samples was not a significant factor in influencing the concentrations of minerals and sugars.

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Principles of Peer Interviewing

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Abstract

Peer interviewing is a process for hiring employees that utilizes the people within the organization to gain a more complete idea of a candidate's appropriateness for a position. The advantages and disadvantages of this approach are discussed and follow up procedures are provided to assist organizations with employee retention and satisfaction. The approach is presented as an option for managers and supervisors to use as a tool to facilitate better hiring practices and also as a way to encourage employee commitment to the organization.

Introduction

Quint Studer, performance excellence consultant and a "fire starter" for the healthcare industry, is working to inspire organizations to hardwire excellence into the way they do business. There are many components to his plan, but according to Studer, "it all starts with selection" (2003, p.168). In today's industry, managers and their staff must have many critical skills in order to be successful. One of the basics is to build individual accountability by asking employees to participate in hiring their co-workers. This is done through a process called "peer interviewing." Peer interviewing is a selection process where team members are allowed to evaluate job candidates and assist in their hiring. Many successful companies such as Motorola and IBM use this process (Pentilla, 2005). It is not a process that a company would want to implement unless they had trained their leaders and assured that all individuals involved were medium to high performers (Studer, 2003).

Effective Interviewing Teams

Effective interviewing teams are representative of the organization, the work group, and the position being filled. Frase-Blunt (2001, p. 72) offers advice for interviewing teams, "Look for diversity in age, race, etc., but also look [for differences] in thought, geography, and maturity. Blend newcomers with old-timers." Successful peer interviews start with trained interviewers. Training should focus on gaining an understanding of the selection process, developing performance standards, listening to briefings on illegal questions, drafting behavioral- based questions, and learning interviewing techniques. Many of these types of training workshops exist and can be conducted by internal or external facilitators (Studer, 2003; Allen & Thrasher, 1998).

Organizational Fit

It is important to understand that the manager should only present peer teams with candidates whom they would like to see hired. Candidates also need to be sufficiently briefed and informed so that they may be prepared for a potentially new interview experience (Frase-Blunt, 2001). The experience can change or reinforce the candidate's opinion about the company. One candidate who was interviewing for an open Information Technology (IT) position at Amazon.com said, "We learned plenty about each other, and the experience reinforced my opinion of the company as a very structured place full of smart people. I saw that clearly for myself" (Frase-Blunt, 2001, p. 77).

Advantages to Peer Interviewing

Advantages to peer interviewing are numerous. With this technique, most of the employees that will have constant contact with the new hire will already like the person. Employees will also feel more comfortable when it comes time to start working with the employee because they know they have confidence in the new hire's abilities. Personal credentials of new employees can become evident during the peer interview (Montgomery, 1996). This goes beyond the written resume and gets at subtleties of the candidate's style. Evaluating the "softer" elements such as body language, how things are said, and reactions to difficult questions will go a long way toward identifying how this person will fit in and perform with the group (Montgomery, 1996). Peer interviews can also help develop a sense of cohesiveness among interviewers (Allen & Thrasher, 1998). Participation in peer interviewing allows employees to have ownership in the selection process. This

has been shown to decrease turn over rates because they have a vested interest in making sure the person offered the position will be successful and stay on long-term (Pentilla, 2005).

Disadvantages to Peer Interviewing

There are some disadvantages to the peer interviewing process and times when it is not always the most appropriate method. Teams may experience problems when there are several qualified candidates and only one open position. Also, time spent preparing for and conducting peer interviews can become too much for employees when they have a lot of other responsibilities (Allen & Thrasher, 1998). When an individual is asked to leave a company, a team interview for their replacement may not be in the best interest of the candidate. Often times, emotions can run high if they are involved in the reason the previous person was terminated (Frase-Blunt, 2001). Other disadvantages include loss in production time due to employees being away from their job during the interview process and the intimidation factor for the candidate when a panel of several people interviews them.

The Studer Way

Quint Studer (2003) takes the peer interviewing process one step further. His steps to success start before the application is even filled out. Potential employees can be asked to sign an agreement expressing the core values and performance standards of a company. This agreement ensures that the employee knows if their behaviors align to those of the company. This way, potential employees who cannot accept or live with the performance standards know there is a disconnect in advance and can choose other career opportunities.

To ensure that the interview team shares the same understanding about what they are looking for in a candidate, Studer devised a decision matrix that emphasizes key criteria for the position and key attributes needed. The decision matrix can be critical to a successful hire as it ensures consistency and accuracy when questioning potential candidates. It is particularly effective when the potential candidate comes from inside the organization and may already have relationships built with the interviewers, but emotional decisions are more difficult to make when using this method.

Behavior-Based Interviewing

Behavior-based interviewing is also a critical component in conducting peer interviews. The best way to determine how an employee will conduct his or herself in a future job is by looking at past behavior ("It's not your grandfather's", 2005). Teams select their questions (based on the decision matrix) prior to the interview. This method allows a manager to collect responses and formulate a decision based on a consistent format. Managers must trust their employees' decisions and should support any candidate that is recommended (since they only allowed qualified candidates to be interviewed in the first place).

Traditional behavior-based interviews are said to predict a successful candidate about half the time (Frase-Blunt, 2001). Team-based interviewing can help to develop unified and cohesive opinions that are thought through and based on multiple perspectives, rather than one individual's opinion. Teams can relate to and understand how each candidate can fit in with the corporate culture and what kind of qualities would make them successful.

Continuing the Relationship

Once the right employee is hired, relations with peers do not end. Studer (2003) outlines a critical component to hardwiring excellence into all employees that also helps with employee retention rates. New employees meet with the manager again on their 30th and 90th days of employment. Four questions are asked during those meetings that focus on key areas and opportunities for growth for both the new employee and the manager. First, the employee is asked how his or her role in the workplace compares to what was said during the interview. Next, the employee is asked what the company is doing well and who has been the most helpful. Following this question, employees are asked what kinds of things were done at their previous job that could make the new job better. Finally, employees are asked if they are uncomfortable with any part of or person associated with the job and if that might cause them to consider leaving. Any suggestions or considerations should be followed up on and taken very seriously. This process facilitates an open line of communication and ensures that the employee knows that the company values them as an individual as well as their opinions. This process has been shown to significantly decrease employee turnover rate among all participating organizations (Studer, 2003).

Conclusion

Evolving workplace cultures call for educated and experienced workers. Peer interviews allow a company to hire the right people at the right time. Hiring the right people ensures the success of any organization. The process of peer interviewing allows an organization to not only hire the most qualified person for the job but also the person who is the best fit for the organization's goals and other personnel. Providing the peers with an opportunity to handpick the people they work with can strengthen the current employees' commitment to the organization and create a community atmosphere that facilitates optimum productivity. Continuous refinements will need to be made to tailor a peer interview team to meet the needs of each organization.

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The cover sheet should include the following information:
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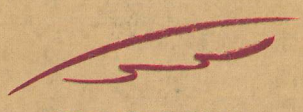

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